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A Tale of Three Cities: The Dynamics of Manufacturing in Toronto, Montreal, and Vancouver, 1976-1997

by Tara Vinodrai

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No. 177

11F0019 No. 177
ISSN: 1200-5223
ISBN: 0-660-18669-1

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November 2001

Aussi disponible en français

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Abstract

Recent research has suggested that investment has shifted from urban areas to more rural locales. However, Canadian manufacturing remains predominantly an urban activity with more than 40% of manufacturing employment located in Canada's three largest urban regions. This paper examines the changing manufacturing landscapes of Toronto, Montreal and Vancouver and outlines the shifts in industry mix, employment, and wage levels that have taken place over the period between 1976 and 1997. The analysis uses a longitudinal plant-level database based upon the Annual Survey of Manufactures conducted by Statistics Canada.

Toronto and Vancouver both experience growth in the manufacturing sector, while Montreal experiences decline driven by differences in their industrial structure. Manufacturing activity has increased in a number of sectors of Toronto's economy, but has been particularly influenced by the growing automotive sector that ties the city to a large North American market. Montreal has experienced declines across most of the manufacturing industries. A heavy concentration of employment in labour intensive industries such as textiles and clothing, which have experienced severe declines across Canada, has amplified the level of decline in Montreal. However, Montreal has seen some growth in science-based industries. While Vancouver's manufacturing economy is much smaller in absolute terms, maintaining slightly less than a 5% share of national manufacturing employment, it has exhibited higher levels of long-run growth and restructuring than its eastern counterparts.

A second focus of the paper is to explore the relationship between economic volatility and diversity in the manufacturing sector using a number of statistical measures. Toronto and Montreal have diverse industrial structures, although each has become slightly more concentrated over the study period. In Montreal, this is due to the increasing importance of other industries, as the clothing and textiles industry declines. In Toronto, this can be attributed to the increased importance of the food and transportation equipment industries. Vancouver has become increasingly diversified over the study period, reflecting the growth and dynamism of this sector. The mature manufacturing economies of Toronto and Montreal exhibit lower levels of volatility than their western counterpart.

Keywords: manufacturing, urban economies, Canadian cities, employment, structural change, diversity, and volatility

Executive Summary

Researchers and policy makers often muse about the extent to which large cities are the central magnet around which economic activity will continue to be organised. Recent research shows that Canadian manufacturing activity continues to be largely an urban activity—though there has been some movement from the central cores of the largest metropolitan areas (Baldwin, Brown and Vinodrai, 2001).

Although important in the national context, the role of metropolitan areas as anchors of regional economies is probably paramount. Montreal is central to Quebec's economy; Toronto is the anchor of Ontario's; and Vancouver is the heart of the British Columbia economy. Located in different parts of Canada, with different histories, industries and markets, these regional economies may have followed different paths over the past quarter century. In short, whether these urban economies have become more dynamic over time can have broad implications for themselves and the regions in which they are found.

There are several questions that this paper seeks to answer regarding manufacturing activity in Canada's three principal metropolitan areas:

1) *Has there been a differential rate of growth in the large urban areas – Toronto, Montreal and Vancouver over the period 1976 to 1997?*

   - Toronto and Vancouver have increased their share of employment in manufacturing while Montreal has declined. The analysis also shows that, across a broad selection of performance measures (e.g., share of shipments, number of plants, and number of head offices), Toronto has been the most consistent performer of the three city-regions.

   - Toronto has also increased its share of manufacturing within Ontario; Vancouver has done likewise relative to total manufacturing employment in British Columbia; Montreal has suffered a decline relative to total manufacturing in Quebec. Therefore, Canada's large urban economies, with the exception of Montreal, have been among the most dynamic economies within their respective provinces over the past twenty-five years.

2) *Are the differences in growth similar across all industries or have the differences primarily been driven by a subset of industries?*

   - Growth in Toronto, although encompassing a broad range of sectors, has largely resulted from increases in the auto sector and related industries.

   - The decline in Montreal has occurred across different industries but was primarily the result of its heavy focus on old labour-intensive industries, such as textiles and

clothing. The one bright spot for Montreal lies in the increase in 'science-based' industries (e.g., aircraft and aircraft parts).

- In contrast to Toronto and Montreal, whose growth was dominated by a few industries, Vancouver saw broad-based growth across a number of sectors. These sectors range from natural resource based industries like food processing to science based industries such as communications and electronic equipment.

3) *Are there differences in the wages paid in the three cities?*

- At the beginning of the period, the wage for production workers was highest in Vancouver followed by Toronto and then Montreal. Over the period, the wage in Toronto increased relative to Montreal, particularly since 1980. But the wage rate in Vancouver, which was 20 % higher than in Toronto in the late 1970s, declined to the level in Toronto by the mid 1990s.

- Montreal's wage rates tended to lag those of Toronto and Vancouver's, in part, because Montreal's industrial structure was dominated to a higher degree by industries that paid low wages.

4) *Do we observe significant differences in terms of industrial diversity of the manufacturing economies of Toronto, Montreal and Vancouver?*

- Toronto and Montreal were more diversified than Vancouver in 1976, but changes over time decreased the disparity until there was little difference by 1997. In both Toronto and Montreal, the percentage of employment that is accounted for by the largest four industries increased, while in Vancouver it decreased. The decrease in diversity over the time period was greater in Montreal than in Toronto.

5) *Do we observe significant differences in terms of the volatility of the manufacturing economies of Toronto, Montreal and Vancouver?*

- Toronto and Montreal were less volatile than Vancouver, when volatility is measured in terms of the variance of the employment growth rate. Changes in diversity have had little affect on this measure of volatility.

- Toronto and Montreal were also less volatile than Vancouver, when volatility is measured by the change in relative employment shares of constituent industries. This measure shows that Toronto experienced lower levels of restructuring compared to Montreal in the 1970s and 1980s. But in the early 1990s, Toronto's restructuring was higher than that of Montreal.

Overall, this paper shows that the manufacturing sectors of Toronto, Montreal and Vancouver have changed slowly but perceptibly over the last quarter century. Toronto and Vancouver increased their shares of national and provincial manufacturing employment, while Montreal

experienced a declining share of both. These broad trends belie unique positive and negative trends for each of these cities. Montreal, although experiencing decline across most sectors, also had the most dynamic science-based industries, an indication of the strength of the new economy in Montreal; Toronto experienced strong growth over the period, but also saw significant restructuring in the early 1990s; Vancouver experienced broad based growth, but workers in the region are no longer paid well above the national average and they also work in an economy that remains the most volatile.

Acknowledgements

The author would like to extend many thanks to John Baldwin of the Microeconomic Analysis Division, Statistics Canada and Mark Brown of the Department of Geography, McGill University and the Microeconomic Analysis Division, Statistics Canada for guidance and helpful suggestions. The author thanks Professor Ehrensaft of the University of Quebec at Montreal and Robert Campbell of McGill University for their work on the Beale geographic codes and Bob Gibson for his extensive work in developing the database used in the preparation of this paper. The author also wishes to thank Bruno Pépin of Manufacturing, Construction, and Energy Division, Statistics Canada and Henry Puderer of Geography Division, Statistics Canada, as well as two anonymous reviewers for their helpful comments.

1. Introduction

Cities are the primary centres of employment, business and industry. In the United States, studies indicate that a high, but diminishing, proportion of manufacturing activity occurs in American cities and urban areas (Bernat, 1997; Gale, 1997). In Canada, a very small number of cities across the country are home to a high proportion of the population and industrial activity. Three major city regions account for slightly more than 40% of Canadian manufacturing employment and shipments: Toronto, Montreal, and Vancouver.

Each of these cities has followed its own industrial path to development and has been differently affected by changes in the Canadian economy. Montreal is situated in the province of Quebec, a region that has been declining in relative economic importance (Coffey and Polèse, 1999). Traditionally, the region has been dominated by labour intensive industries such as the clothing and textiles industries. Toronto is located in the centre of the southern Ontario manufacturing belt—which constitutes the heartland of manufacturing activity in Canada. The industries in this region are mainly scale-based industries (such as the auto industry) and have been the target of Canadian industrial and trade policy initiatives, including the North American Free Trade Agreement (NAFTA) and its predecessors. Finally, the Vancouver region in British Columbia—once viewed as being at the fringe of the Canadian economy—has developed and matured through increasing ties with the Pacific Rim economy and through the vitalization of western Canada's economy, and has become more dynamic than its eastern counterparts in several respects. Consequently, the health of each of these cities' economies is strongly influenced by change within the Canadian manufacturing sector.

Due to the importance of the manufacturing sector to the economic health of these Canadian cities, this paper investigates the changing industrial landscape of Toronto, Montreal, and Vancouver. This study draws upon a longitudinal database of manufacturing establishments derived from Statistics Canada's *Annual Survey of Manufactures* to examine the changing industrial structure and performance of Canada's largest city-regions between 1976 and 1997. First, the dimensions of manufacturing activity in each of these three city-regions are examined in national and provincial context. These dimensions include production worker and non-production worker employment, shipments, and plant and head office locations—all of which begin to characterize and build a picture of each urban region. The evidence presented confirms the dominance of these three regions in terms of their national share of employment and shipments. Toronto and Montreal have historically been centres of manufacturing, although Montreal is in a state of relative decline whereas Toronto has improved its relative position.

A large and growing body of research has addressed questions regarding how cities and regions have changed in response to transitions in the economy and to changes in the nature of production and employment (Barnes and Gertler, 1999; Clark, et al., 2000). Therefore, how each of these three cities has changed through time is examined more closely. The changing dimensions of manufacturing employment are examined in greater detail to see how they are related to, and driven by, the success of various sectors within manufacturing. An analysis of the sectoral composition and the growth (and decline) of particular industries within these regions, including shifts in

employment between major industry groups is conducted. Vancouver exhibits growth across all sectors whereas the growth and decline of Toronto and Montreal are more sector-specific. In Montreal, decline has been fuelled by the textiles and clothing industry. In Toronto, manufacturing activity has increased in a number of sectors, but has been particularly influenced by the growing automotive sector.

Implicit in the question of how the manufacturing economies of these cities have developed differentially is the question of performance. Not all cities or regions are equally successful. There is extensive debate as to whether or not industrial specialization or diversity in cities and regions leads to economic growth (Duranton and Puga, 2000; Feldman and Audretsch, 1999; Porter, 1998; Glaeser, et al., 1992; Scott and Storper, 1992; Amin and Robins, 1990; Jacobs 1969, 1984). On the one hand, it is argued that diversified cities are more dynamic and provide greater economic benefits (Jacobs, 1969, 1984). Others have argued that specialized cities or regions can gain competitive advantages and benefit from externalities associated with this specialization (Porter, 1998; Sabel, 1994). In this paper, the performance of the various sectors within Canadian manufacturing is examined across these regions. The extent of concentration, diversity, and change in each region is discussed, as well as differences in the volatility of the manufacturing sector in these city-regions.

There are a number of ways of measuring the performance and dynamics of cities. In the first instance, this paper uses relative wage rates to gauge the performance of the manufacturing sector in each of these urban areas. Montreal lags Toronto and Vancouver in terms of production worker wage rates. The second measure of performance used here is the volatility of employment growth rates. The paper investigates whether the manufacturing industry has become more concentrated in each city-region and how this has affected the volatility of employment growth rates. The evidence suggests that Montreal and Toronto follow fairly similar trajectories, becoming more concentrated through time, whereas Vancouver has become more diversified through time. In addition, Toronto and Montreal have had less volatile employment growth than Vancouver. Change in levels of diversity or industrial concentration has had a negligible influence on levels of volatility in employment growth. Finally, the paper investigates the degree to which changes have been occurring in industry market shares—a measure of industrial adjustment and restructuring. Vancouver is once more shown to have the greatest levels of change followed by Montreal and then Toronto. In the 1990s, the amount of industrial adjustment increased in both Toronto and Vancouver.

The remainder of the paper is organized as follows. First, a description of the data, methods, and measures used throughout the paper is provided. The paper then turns to a discussion of the results, divided into three sections. In the first section, the Toronto, Montreal and Vancouver city-regions are placed in a provincial and national context. Second, the changing industrial structure and composition across each city-region is examined. Third, the similarities and differences in the pattern of manufacturing and development across the regions are discussed. Specifically, sector employment changes, relative wage rates, and patterns of diversification and concentration between the city-regions of Toronto, Montreal, and Vancouver are examined. The paper concludes by summarizing the findings and considering areas of further research.

2. Data and Methods

2.1 Defining "City-Regions"

This paper is part of a larger study that examines the changing dynamics of the Canadian manufacturing sector across the urban-rural hierarchy (see Baldwin, Brown and Vinodrai, 2001). The urban-rural continuum is defined using a modified version of the U.S. Department of Agriculture's Beale code system (Beale, 1984; Butler, 1994). In the United States, the Beale code system was used to classify counties first on the basis of whether they belonged to a metropolitan area and then on the basis of the population of the metropolitan area. In non-metropolitan areas, counties are classified according to their location relative to metropolitan regions (i.e., adjacent or non-adjacent to a metropolitan region). The resulting original U.S. classification scheme had eleven categories. This system has been adapted to be compatible within the Canadian context using census divisions, which are roughly equivalent to counties in the United States. The system for Canada uses only six categories, rather than eleven, to preserve the confidentiality of respondents (Table 1).

The Beale classification system identifies census divisions (CDs) as being major metro areas or part of their fringes, a medium sized metro area, a small metro area, or part of a rural region based on proximity to, and the population size of, Census Metropolitan Areas (CMAs) and Census Agglomerations (CAs). Census divisions are used since they are the most stable geographic unit at the sub-provincial level in Canada.

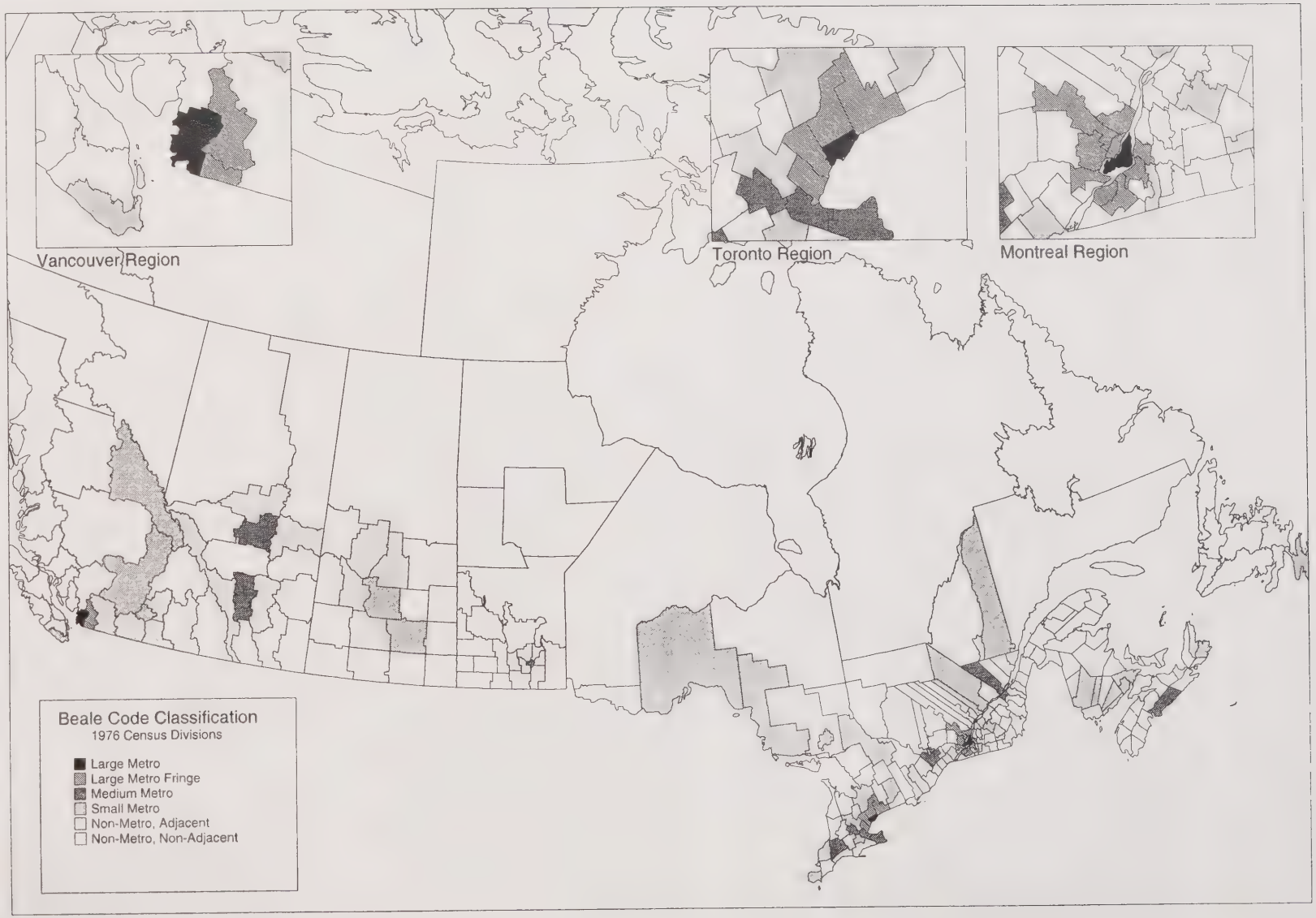
Table 1. Modified Canadian Beale Classification System

Beale	Beale Category	Description
0	Large Metro	Central and most populous census division of a CMA[a] that has a population greater than 1 million
1	Large Metro Fringe	Remaining census divisions within or partially within a CMA that has a population greater than 1 million
2	Medium Metro	Census division(s) containing, within, or partially within a CMA/CA[b] that has a population between 250,000 and 999,999
3	Small Metro	Census division(s) containing, within, or partially within a CMA/CA that has a population between 50,000 and 249,999
4	Non-metro, adjacent	Census divisions that share a boundary with a CMA/CA that has a population greater than 50,000
5	Non-metro, non-adjacent	Census divisions that do not share a boundary with a CMA/CA that has a population greater than 50,000

[a] Census Metropolitan Area
[b] Census Agglomeration
Note: Since CMA/CA boundaries are different from census division boundaries, census divisions may 1) contain entire CMA/CAs; 2) fall entirely within a CMA/CA; or 3) be only partially within the territory of a CMA/CA.

This paper focuses on Canada's large metro regions (Toronto, Montreal, and Vancouver) and their fringes defined using the Beale code system. In this paper, these regions are referred to as "city-regions" and are defined as the composite of the census divisions classified as "Large Metro" (one census division for each of the three regions) and its surrounding census divisions classified as "Fringe Metro" at the beginning of the study period (Figure 1).

Figure 1. Canadian Beale Classification System Based on 1976 Census Divisions



Source: Statistics Canada, 2000

The limitation to using these city-regions, as defined above, is that the geographic definitions for Toronto, Montreal, and Vancouver are not the most common ones. Thus, caution must be exercised in comparing these results to other studies of these regions. The boundaries of these cities are usually defined using the Census Metropolitan Area (CMA) concept that uses census subdivisions to delineate territory. This study is limited to using census divisions since it is the finest level of geographic detail available for use with this dataset. However, the combination of "large metro" and "fringe" census divisions provides a very close approximation of these metropolitan regions. Table 2 shows that each city-region has a population that is largely the same as its corresponding CMA. A very high proportion (more than 96% in all cases) of the CMA population is included in the city-region definition adopted in this paper. It should be noted that in each case, the city-region has a slightly larger population than its matching CMA, although at least 90% of the population in each city-region is shared with its corresponding CMA. Figure 2 shows the differences in the geographic area covered by each definition.

Table 2. Comparing City-Region and Census Metropolitan Area Definitions

	City-Region Population	CMA Population in City-Region	Non-CMA Population in City-Region	CMA Population	% CMA included
Toronto	4,628,883 (100)	4,192,592 (90.6)	436,291 (9.4)	4,263,757	98.3
Montreal	3,367,637 (100)	3,204,257 (95.2)	163,380 (4.8)	3,326,510	96.3
Vancouver	1,972,425 (100)	1,831,665 (92.9)	140,760 (7.1)	1,831,665	100.0

Note: Based on the 1996 Census of Population. CMA boundaries are defined using the 1996 Census definition.

The data are from a plant-level database containing longitudinal records for manufacturing establishments in Canada from their year of entry to their year of exit, derived from the Annual Survey of Manufactures (ASM). The longitudinal file covers the years between 1976 and 1997. Each manufacturing plant is assigned to a Census Division and its corresponding Beale code. Census division boundaries are redrawn every five years with the advent of the Canadian Census of Population. Therefore, for each census year (1976, 1981, 1986, 1991 and 1996), Census Divisions are assigned to a Beale category according to the criteria discussed above.

This study attempts to hold the geographic areas of the core urban areas and their surrounding fringes constant since the study is aimed at ascertaining whether the industries in the different urban areas have been inherently more dynamic, not whether one area has done better than another by absorbing other areas (see Appendix 1). This exercise is hampered by the reclassification and redrawing of boundaries as cities expand, forming larger city-regions. If this is not corrected, growth in these city-regions could be attributed either to the fact that industries in these areas were inherently more dynamic or because of boundary changes. In order to measure change over time within these regions, the area classification scheme applied at the beginning of the study period (1976) is held constant throughout the study period.[1] To do so, two distinct problems need to be addressed. First, there is the question of area reclassification. Since the "Large Metro" census

[1] It is also possible to apply the classification scheme using the end period, in this paper there are a number of reasons for not doing so. First, given that the area covered by each city-region is slightly larger than its 1996 CMA counterpart, it is likely that the majority of new growth is captured and that these city-regions accurately define these urban areas through time (see Figure 2). Second, there were data constraints related to creating a consistent framework using the 1996 census geography as the base.

divisions for Montreal, Toronto, and Vancouver are static through time, this is only an issue if new areas are added to the "Fringe Metro" category—which is the case in all three of these city-regions. Second, census division boundaries in Quebec were redrawn in 1991 resulting in a complete redefinition of census division boundaries in that province, further complicating the interpretation of the data. To address these issues, plants were classified according to their location within the urban hierarchy using the 1976 census boundary definitions; Beale codes were then assigned based on the 1976 Beale classification. This results in a geographic framework that is consistent through time.

2.2 Measuring Performance and Industrial Change

To capture the changes in the industrial composition of these city-regions through time, a number of different measures are used. The first part of the paper provides a picture of manufacturing in each city-region using breakdowns of employment and shipments by industry sector. The second part of the paper compares the industrial performance and levels of structural adjustment and change experienced in each region. Annual employment growth rates and relative wage rates are compared across different manufacturing sectors. To address the question of how different (or similar) each city-region is in terms of its industry specialization or concentration, a number of common concentration and specialization measures are used. The characteristics of each city-region are quantified using a series of indices that compare employment shares within industries at the regional and national level. Industries are defined at the 4-digit level using the 1980 Standard Industrial Classification system. Data collected prior to 1980 were adjusted using a commodity concordance table to allow for consistency throughout the study period.

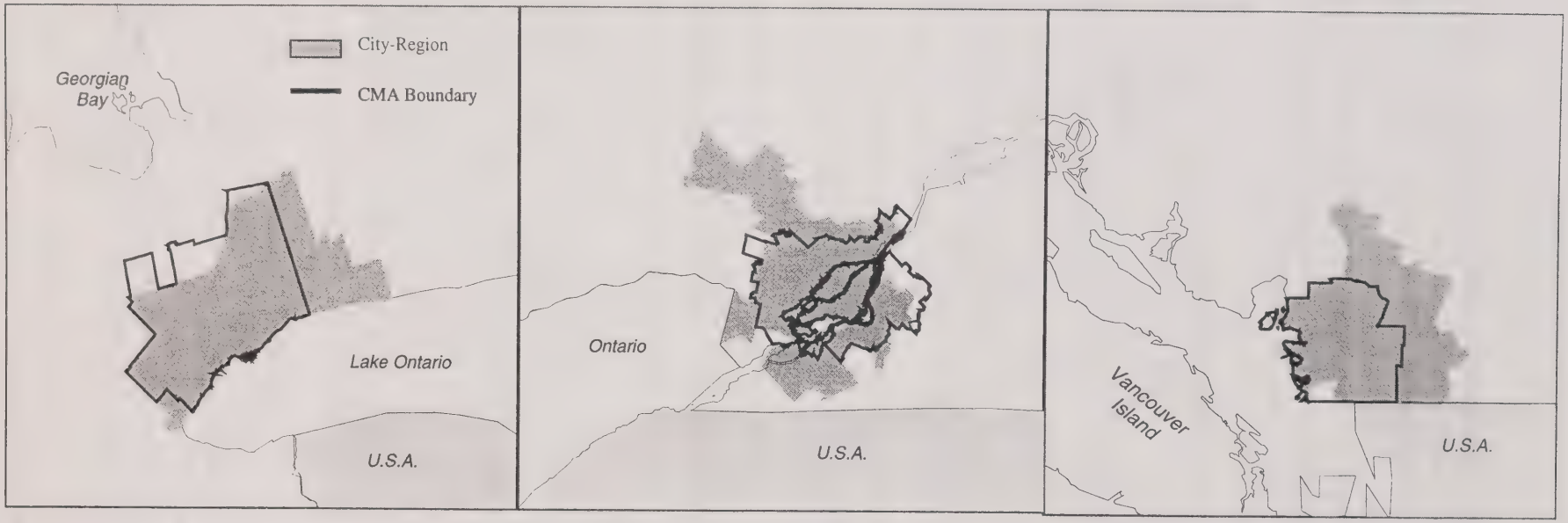
3. Manufacturing in Canada's Largest City-Regions

3.1 A National and Provincial Context

Manufacturing in Canada has been predominantly located in urban areas or on their fringes. Overall, these three regions accounted for a relatively constant share of manufacturing employment and shipments in Canada throughout the study period (Table 3). However, the relative importance of each region has changed. Montreal has become a less important part of the Canadian manufacturing sector whereas Toronto has become more important throughout the study period, both in terms of shipments and employment. Vancouver's contribution to national employment increased slightly throughout the period, whereas its contribution to national shipments declined slightly.

It is important to make a distinction between production and non-production workers, since there are differences between these two categories of employees within the manufacturing sector. Non-production workers are more heavily concentrated in these three regions compared to production workers, accounting for slightly more than 50% of all non-production workers nation-wide. Of note is the relatively steady share of non-production workers across all three city-regions. Even though Montreal declined in its overall importance to the Canadian manufacturing sector and has a declining share of manufacturing employment and shipments at the national level, this decline in employment share can be mainly attributed to the declining proportion of production workers. It also interesting to note that most of Toronto's gain in employment share has been through a significant increase in the proportion of production workers.

Figure 2. Comparing City-Region and Census Metropolitan Area Definitions



a) Toronto city-region **b) Montreal city-region** **c) Vancouver city-region**

Note: (1) City-regions are defined using 1976 census division boundaries.
(2) Census Metropolitan Areas are defined using 1996 census subdivision boundaries.

Source: Statistics Canada, 2001

Each region in this study is an integral part of a provincial production system, accounting for a large (but changing) proportion of employment (Table 4). While Toronto remains an important manufacturing employer nationally, it has become even more important within the province of Ontario. The same is true of Vancouver, although Vancouver's increase in provincial share in British Columbia is limited to an increase in its share of production workers. Montreal declined in its relative importance compared to the rest of the province of Quebec meaning that, in addition to decreasing in importance nationally, Montreal has declined in importance relative to the rest of the province of Quebec.

Table 3. Contribution of City-Regions to National Manufacturing

	Total Employment		Production Workers		Non-Production Workers		Manufacturing Shipments	
	1976	1997	1976	1997	1976	1997	1976	1997
Toronto	22.3	24.4	20.6	23.8	26.9	26.4	22.0	25.0
Montreal	17.8	14.2	17.0	12.5	19.9	19.8	15.2	11.4
Vancouver	4.3	4.7	4.0	4.7	4.8	4.7	4.2	3.8
Total	*44.3*	*43.4*	*41.7*	*41.0*	*51.7*	*50.9*	*41.5*	*40.2*

Note: All numbers represent a percentage of the Canadian total. Numbers may not add due to rounding. Cities are defined using census divisions rather than the standard CMA definitions.

Table 4. Contribution of City-Regions to Provincial Manufacturing Employment

	Total Employment		Production Workers		Non-Production Workers	
	1976	1997	1976	1997	1976	1997
Toronto	45.6	50.4	42.7	48.3	53.1	57.9
Montreal	59.0	52.3	55.9	48.6	67.6	61.9
Vancouver	52.6	55.5	48.6	53.7	65.0	62.4

Note: All numbers represent a percentage of provincial totals. Cities are defined using census divisions rather than the standard CMA definitions.

Table 5. Plant and Head Office Locations

	All Establishments				Plants				Head Offices / Auxiliary Units			
	1976		1997		1976		1997		1976		1997	
	#	%	#	%	#	%	#	%	#	%	#	%
Toronto	6442	21.1	8014	21.7	5956	21.2	7546	21.6	486	20.8	468	23.3
Montreal	5499	18.0	5470	14.8	5057	18.0	5132	14.7	442	18.9	338	16.8
Vancouver	1988	6.5	2862	7.7	1766	6.3	2706	7.7	222	9.5	156	7.8
Total	*13,929*	*45.7*	*16,346*	*44.2*	*12,779*	*45.4*	*15,384*	*44.0*	*1,150*	*49.1*	*962*	*47.9*

Note: All percentages expressed as a proportion of the Canadian total. Numbers may not add due to rounding. Cities are defined using census divisions rather than the standard CMA definitions.

In addition to accounting for a large proportion of employment (provincially and nationally), these three city-regions also accounted for approximately 45% of manufacturing establishments in Canada during the study period (Table 5). These cities accounted for a larger percentage of head offices[2] than operating plants. Companies tend to locate their head office function in urban areas and their fringes. However, given the prominence of these three cities both nationally and internationally, it is somewhat surprising that in the Canadian manufacturing sector, slightly less than 50% of head offices are located in the

[2] Head offices are defined as those management units that operate separately from production establishments. Offices that are part of operating establishments are not part of this count.

Toronto, Montreal, and Vancouver city-regions. This suggests that head office functions may not be as concentrated in large urban centres or that head offices are located at the sites of production. Additionally, this may also be a function of foreign ownership.

Only Toronto increased its national share of head office facilities during the study period, whereas both Montreal and Vancouver witnessed a slight decline. However, there has been an absolute decline in the number of manufacturing head offices across all three city-regions, which is in keeping with the national trend, where there was a 14% decline in the number of head offices across the country. This decline was felt to varying degrees across regions. Toronto experienced only a 4% decline in its absolute number of head offices whereas both Montreal and Vancouver had greater declines of 24% and 30% respectively.

While each of these three regions has experienced a decline in the number of head offices, each saw an increase in its number of operating plants. Toronto experienced a 27% increase in the number of plants, slightly increasing its national share. Similarly, Vancouver had a 63% increase in its number of plants, resulting in an increase in its national share from 6.3% to 7.7%. While Montreal experienced a 1% increase in its number of operating plants, it reduced its national share from 18% to 14.7%. Overall, these results point to the relative decline of Montreal as a centre for manufacturing activity throughout the period, as well as the increased importance of the Toronto region as a manufacturing centre.

3.2 Sectoral Composition of Canada's Largest City-Regions

Each of these city-regions is important to Canadian manufacturing both at the national and provincial level, although Montreal has experienced relative decline and Toronto has experienced relative growth during the study period. However, these numbers only present a snapshot of the manufacturing sector at a highly aggregated level. To better understand the dynamics of manufacturing in large Canadian cities the manufacturing sector is divided into five sectors: natural resources, labour intensive, scale-based, product differentiated, and science-based (see Appendix 2).[3] Each sector is defined by key characteristics of the competitive process in that particular group of industries. Natural resource industries (e.g., food processing, plastics) have a small value-added to material input ratio. Labour intensive industries (e.g., clothing and textiles) are typified by low wages and labour is the largest cost in production. Scale-based industries (e.g., motor vehicles, steel) are those that can achieve scale-economies in production and are typically capital intensive. Product-differentiated industries (e.g., furniture) are those that produce tailored products and can change production rapidly to meet market demands and tend to have higher marketing to sales ratios. Finally, science-based industries (e.g., electronics products, pharmaceuticals) are those with higher R&D to sales ratios.

[3] Baldwin and Rafiquzzaman (1994) use a discriminant analysis to divide the 236 4-digit manufacturing industries into five groups based on a number of key characteristics (e.g., R&D to sales ratios, plant size, wage rates, etc.). Although the classification is based on an empirical exercise, some of the results may seem counterintuitive at first glance. For example, sawmills are often considered a resource-based industry, however, in the Canadian context, their characteristics more closely resemble those of other Canadian scale-based industries and are classified accordingly.

3.2.1 Manufacturing in the Toronto City-region

In the Toronto region, all sectors except the labour intensive sector have experienced an upward trend in employment throughout the study period (Table 7). Between the beginning of the study period and the late 1980s, employment increased across all sectors in the Toronto city-region. The 1990s recession brought about a decrease in employment across all sectors, but it was most evident in the labour intensive industries, where there was a decrease of almost 30,000 workers between 1989 and 1992. There was a decrease of almost 15,000 workers in the natural resource based industries and almost 10,000 in the scale-based industries during that same time period. The science-based industries were least affected by the recession. In the mid-1990s, employment began to increase across all sectors. Overall, employment growth was most pronounced in the scale-based industries.

The importance of scale-based industries to manufacturing in Toronto is confirmed by examining the top employing industries (Table 6). Moreover, the increasing dominance of the motor vehicle industry is evident. By 1996, three of the top ten industries were directly related to the automotive sector compared to only one of the top ten at the beginning of the study period.

In Toronto, employment shares in product differentiated and science-based sectors remained relatively static throughout the study period (Figure 3). However, the Toronto region has realized increases in the employment shares of the scale-based industries, which includes various components of the automotive sector. Toronto's natural resources sector has witnessed an increase in its relative share of employment. There has been a decrease in the employment shares of the labour intensive industries that can be attributed to the decline of the clothing and textiles industries, amongst others.

Figure 3. Changing Composition of Manufacturing Employment in Toronto, 1976-1997

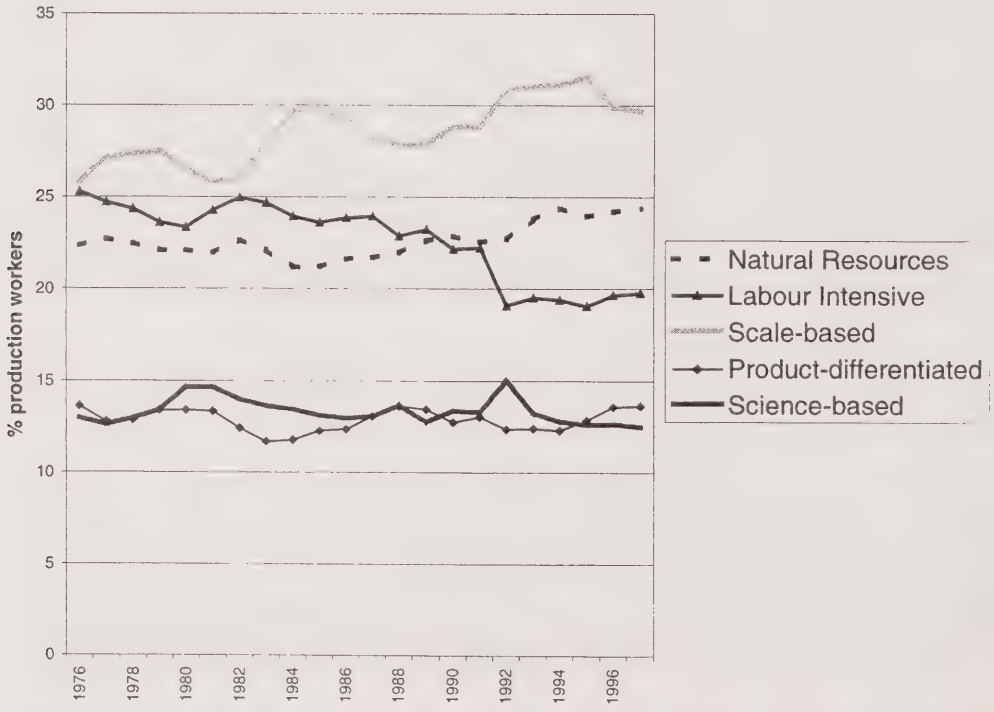


Table 6. Top 10 Industries by Total Employment in Toronto, 1976-1996

SIC	Description	Sector	1976	1986	1996
3231	Motor Vehicle Industry	Scale	1	1	1
2819	Other Commercial Printing Industries	Scale	2	2	2
1699	Other Plastic Products Industries	Natural	6	4	3
3199	Other Machinery & Equipment Industries	Product	4	5	4
3259	Other Motor Vehicle Accessories, Parts and Assemblies Industries	Scale	-	-	5
3211	Aircraft and Aircraft Parts Industry	Science	7	3	6
3741	Pharmaceuticals and Medicine Industry	Science	-	8	7
1011	Meat and Meat Products Industry	Natural	5	-	8
3253	Motor Vehicle Stampings Industry	Scale	-	-	9
3911	Indicating, Recording, and Controlling Equipment Industry	Science	-	-	10
2821	Platemaking, Typesetting, and Bindery Industry	Scale	-	6	-
2841	Newspaper, Magazine and Periodical Industry	Scale	3	7	-
3359	Other Communications and Electronic Equipment Industry	Science	-	9	-
2839	Other Publishing Industries	Natural	-	10	-
3611	Refined Petroleum Products Industry	Natural	8	-	-
3999	Other Manufactured Products Industries	Labour	9	-	-
1072	Bread and Other Bakery Products Industry	Natural	10	-	-

Note: Natural=Natural Resources, Labour=Labour Intensive, Scale=Scale-based, Product=Product Differentiated, Science=Science-based. Toronto is defined using census divisions rather than the standard CMA definitions.

Table 7. Production Worker Employment by Industry Sector in Toronto, 1976-1997

	Natural Resources Industries	Labour Intensive Industries	Scale-based Industries	Product Differentiated Industries	Science-based Industries	All Industries
	employment (percent share)					
1976	58,700 (22.3)	66,500 (25.3)	67,800 (25.8)	35,800 (13.6)	34,100 (13.0)	262,900 (100)
1977	57,700 (22.7)	62,800 (24.7)	69,000 (27.2)	32,500 (12.8)	32,100 (12.6)	254,100 (100)
1978	61,000 (22.5)	66,100 (24.3)	74,300 (27.3)	35,000 (12.9)	35,200 (13.0)	271,600 (100)
1979	63,500 (22.1)	67,800 (23.6)	79,000 (27.5)	38,500 (13.4)	38,500 (13.4)	287,300 (100)
1980	63,200 (22.1)	66,700 (23.3)	75,900 (26.5)	38,400 (13.4)	41,900 (14.6)	286,100 (100)
1981	62,400 (21.9)	69,100 (24.3)	73,500 (25.8)	38,000 (13.3)	41,700 (14.7)	284,700 (100)
1982	59,700 (22.6)	65,800 (25.0)	68,400 (26.0)	32,700 (12.4)	36,900 (14.0)	263,500 (100)
1983	59,400 (22.1)	66,300 (24.7)	75,100 (27.9)	31,400 (11.7)	36,700 (13.6)	268,900 (100)
1984	60,600 (21.2)	68,500 (23.9)	84,900 (29.7)	33,700 (11.8)	38,500 (13.5)	286,200 (100)
1985	66,300 (21.2)	73,800 (23.6)	93,200 (29.8)	38,400 (12.3)	41,100 (13.1)	312,800 (100)
1986	71,600 (21.6)	79,000 (23.8)	96,700 (29.2)	41,000 (12.4)	43,000 (13.0)	331,300 (100)
1987	75,000 (21.7)	82,700 (23.9)	97,600 (28.2)	45,200 (13.1)	45,200 (13.1)	345,700 (100)
1988	79,300 (21.9)	82,700 (22.9)	100,800 (27.9)	49,300 (13.6)	49,400 (13.7)	361,500 (100)
1989	84,800 (22.6)	87,100 (23.2)	104,700 (27.9)	50,500 (13.5)	47,900 (12.8)	375,000 (100)
1990	79,600 (22.9)	77,100 (22.2)	100,400 (28.8)	44,400 (12.8)	46,600 (13.4)	348,100 (100)
1991	74,200 (22.6)	73,200 (22.2)	95,000 (28.9)	42,900 (13.0)	43,800 (13.3)	329,100 (100)
1992	69,200 (22.7)	58,100 (19.1)	94,000 (30.8)	37,700 (12.4)	45,800 (15.0)	304,800 (100)
1993	70,100 (23.8)	57,400 (19.5)	91,400 (31.0)	36,500 (12.4)	39,000 (13.3)	294,400 (100)
1994	71,300 (24.4)	56,600 (19.4)	90,900 (31.1)	35,900 (12.3)	37,400 (12.8)	292,100 (100)
1995	72,400 (24.0)	57,500 (19.0)	95,200 (31.5)	38,900 (12.9)	38,100 (12.6)	302,100 (100)
1996	78,200 (24.2)	63,500 (19.6)	96,600 (29.9)	43,900 (13.6)	40,900 (12.7)	323,100 (100)
1997	81,900 (24.4)	66,400 (19.8)	99,600 (29.7)	45,800 (13.6)	42,000 (12.5)	335,700 (100)

Note: (1) Employment totals may vary slightly from previously published totals due to data revisions. Numbers are rounded to protect the confidentiality of respondents.

(2) Numbers may not add due to rounding.

(3) Toronto is defined using census divisions rather than by the standard CMA definition.

3.2.2 Manufacturing in the Montreal City-region

Manufacturing employment in the Montreal city-region experienced declines in all sectors except the science-based sector (Table 8). The most dramatic decline in employment was in the labour intensive sector. In 1976, there were approximately 94,500 workers in the labour intensive industries; however, by 1997 there were approximately 54,600 workers in that sector. Significant declines in overall employment can be detected both in the early 1980s and again in the early 1990s, both of which were recession years in Canada. However, these recession period declines were not as pronounced as those experienced in Toronto. The science-based sector was the only sector to exhibit employment growth in Montreal during the study period.

Table 8. Production Worker Employment by Industry Sector in Montreal, 1976-1997

	Natural Resources Industries	Labour Intensive Industries	Scale-based Industries	Product Differentiated Industries	Science-based Industries	All Industries
	employment (percent share)					
1976	45,700 (21.1)	94,500 (43.7)	35,500 (16.4)	20,400 (9.4)	20,000 (9.2)	216,100 (100)
1977	43,100 (21.5)	86,000 (42.8)	32,900 (16.4)	19,800 (9.8)	19,200 (9.5)	201,000 (100)
1978	44,300 (21.3)	85,000 (40.8)	35,500 (17.0)	21,300 (10.2)	22,200 (10.6)	208,300 (100)
1979	44,500 (20.8)	86,400 (40.3)	35,800 (16.7)	20,500 (9.6)	27,100 (12.7)	214,300 (100)
1980	44,400 (20.9)	80,600 (37.9)	36,500 (17.1)	20,400 (9.6)	30,900 (14.5)	212,800 (100)
1981	43,100 (20.7)	77,600 (37.2)	37,300 (17.9)	20,300 (9.7)	30,300 (14.5)	208,600 (100)
1982	39,200 (20.8)	71,600 (38.1)	31,200 (16.6)	18,400 (9.8)	27,700 (14.7)	188,100 (100)
1983	39,500 (21.1)	72,600 (38.7)	32,100 (17.1)	18,200 (9.7)	25,100 (13.4)	187,500 (100)
1984	40,400 (21.2)	74,300 (39.0)	33,600 (17.6)	19,000 (10.0)	23,200 (12.2)	190,500 (100)
1985	42,300 (21.4)	75,300 (38.2)	35,200 (17.8)	19,000 (9.6)	25,500 (12.9)	197,300 (100)
1986	43,600 (21.5)	78,300 (38.6)	35,200 (17.4)	20,700 (10.2)	24,900 (12.3)	202,700 (100)
1987	46,100 (21.9)	80,000 (38.0)	37,100 (17.6)	21,800 (10.4)	25,500 (12.1)	210,500 (100)
1988	47,800 (21.9)	80,500 (36.8)	38,500 (17.6)	22,700 (10.4)	29,200 (13.3)	218,700 (100)
1989	45,100 (21.7)	73,600 (35.4)	37,800 (18.2)	22,500 (10.8)	28,600 (13.8)	207,600 (100)
1990	45,000 (22.4)	71,200 (35.4)	34,800 (17.3)	21,000 (10.4)	29,000 (14.4)	201,000 (100)
1991	40,100 (23.6)	58,600 (34.6)	27,900 (16.5)	16,600 (9.8)	26,400 (15.6)	169,600 (100)
1992	37,900 (23.4)	53,800 (33.2)	27,600 (17.0)	16,000 (9.9)	26,500 (16.4)	161,800 (100)
1993	37,200 (23.3)	51,600 (32.3)	28,900 (18.1)	15,800 (9.9)	26,100 (16.3)	159,600 (100)
1994	38,300 (23.2)	52,800 (31.9)	30,100 (18.2)	17,700 (10.7)	26,400 (16.0)	165,300 (100)
1995	38,700 (23.4)	51,200 (30.9)	29,900 (18.0)	18,300 (11.1)	27,500 (16.6)	165,600 (100)
1996	40,000 (23.7)	52,500 (31.1)	29,200 (17.3)	18,700 (11.1)	28,300 (16.8)	168,700 (100)
1997	42,400 (24.1)	54,600 (31.0)	29,800 (16.9)	20,200 (11.5)	29,300 (16.6)	176,300 (100)

Note: (1) Employment totals may vary slightly from previously published totals due to data revisions. Numbers are rounded to protect the confidentiality of respondents.
(2) Numbers may not add due to rounding.
(3) Montreal is defined using census divisions rather than by the standard CMA definition.

The importance of science-based and labour intensive industries to manufacturing employment in Montreal can be seen when examining the top employing industries (Table 9). In 1976, half of the top ten industries were labour intensive industries related to the clothing industries. Of the remaining five industries, three were science-based. By 1996, only three of the top ten industries were labour intensive, and four were science-based. Despite steep declines in employment in the labour intensive sector, it still remains a key employer along with the growing science-based sector.

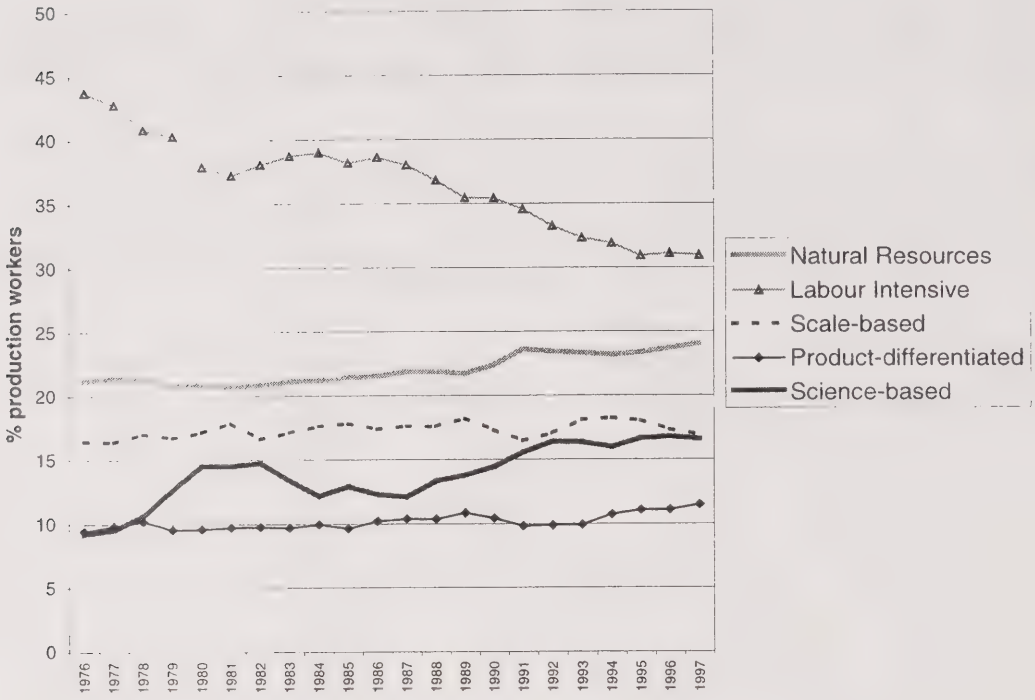
Table 9. Top 10 Industries by Total Employment in Montreal, 1976-1996

SIC	Description	Sector	1976	1986	1996
3211	Aircraft and Aircraft Parts Industry	Science	1	1	1
2819	Other Commercial Printing Industries	Scale	2	2	2
3741	Pharmaceuticals and Medicine Industry	Science	3	4	3
3359	Other Communications and Electronic Equipment Industry	Science	-	3	4
1699	Other Plastic Products Industries	Natural	-	-	5
3199	Other Machinery & Equipment Industries	Product	-	9	6
2432	Men's and Boy's Suit and Jacket Industry	Labour	8	-	7
2442	Women's Sportswear Industry	Labour	6	-	8
2499	Other Clothing and Apparel Industry	Labour	7	5	9
3352	Electronic Parts and Components Industry	Science	-	-	10
2445	Women's Clothing Contractors	Labour	5	6	-
1131	Brewery Products Industry	Natural	-	7	-
3231	Motor Vehicle Industry	Scale	-	8	-
1011	Meat and Meat Products Industry	Natural	-	10	-
2451	Children's Clothing Industry	Labour	4	-	-
3351	Telecommunications Equipment Industry	Science	9	-	-
2841	Newspaper, Magazine and Periodical Industry	Scale	10	-	-

Note: Natural=Natural Resources, Labour=Labour Intensive, Scale=Scale-based, Product=Product Differentiated, Science=Science-based. Montreal is defined using census divisions rather than the standard CMA definitions.

Montreal's labour intensive industries accounted for almost 44% of employment in the region at the beginning of the study period (Figure 4). However, by the end of the study period, the labour intensive industries accounted for slightly more than 30% of employment in the Montreal city-region. This dramatic decrease can be attributed to the decline of the textiles and apparel industries, which witnessed a decrease of approximately 27,000 workers during the study period. In 1976, five of the top ten industries in Montreal were related to clothing and textiles; by 1996, this had decreased to only two (Table 9). While the labour intensive sector declined, the share of employment in the science-based sector increased.

Figure 4. Changing Composition of Manufacturing Employment in Montreal, 1976-1997



3.2.3 Manufacturing in the Vancouver City-region

Unlike the Toronto and Montreal city-regions, the Vancouver city-region experienced employment growth across all sectors, although this was minimal in the scale-based sector (Table 10). After the recession of the early 1980s, employment in the scale-based industries in Vancouver remained relatively static.

There were increases in the employment shares of the labour intensive, science-based, and product differentiated industries, offset by a slight decrease in the employment shares of the natural resource industries and a greater decline in the scale-based industries (Figure 5). However, the natural resource sector remained predominant, accounting for just over a third of employment. This predominance is illustrated by examining the major employers throughout the period, many of which were related to scale-based and natural resource industries (Table 11).

Table 10. Production Worker Employment by Industry Sector in Vancouver, 1976-1997

	Natural Resources Industries	Labour Intensive Industries	Scale-based Industries	Product Differentiated Industries	Science-based Industries	All Industries
	employment (percent share)					
1976	18,000 (34.9)	9,000 (17.5)	17,000 (33.0)	5,300 (10.3)	2,200 (4.2)	51,500 (100)
1977	18,500 (35.7)	8,700 (16.8)	17,600 (34.0)	5,200 (10.0)	1,800 (3.5)	51,800 (100)
1978	20,000 (35.2)	9,000 (15.9)	19,800 (34.9)	6,000 (10.6)	2,000 (3.4)	56,800 (100)
1979	19,900 (33.3)	9,700 (16.2)	21,200 (35.4)	7,000 (11.7)	2,000 (3.4)	59,800 (100)
1980	19,700 (33.6)	10,700 (18.3)	19,200 (32.6)	6,700 (11.3)	2,500 (4.2)	58,800 (100)
1981	20,200 (34.4)	11,100 (18.8)	18,800 (32.0)	6,100 (10.4)	2,600 (4.3)	58,800 (100)
1982	17,700 (34.5)	9,700 (18.8)	16,700 (32.5)	5,100 (9.9)	2,200 (4.3)	51,400 (100)
1983	17,700 (36.3)	9,000 (18.5)	15,200 (31.3)	4,700 (9.6)	2,100 (4.3)	48,700 (100)
1984	17,300 (36.2)	8,400 (17.6)	15,300 (32.1)	4,600 (9.5)	2,200 (4.5)	47,800 (100)
1985	18,800 (36.1)	9,400 (18.0)	16,200 (31.1)	5,300 (10.1)	2,400 (4.6)	52,100 (100)
1986	19,200 (36.8)	9,100 (17.5)	15,600 (30.0)	5,600 (10.8)	2,500 (4.8)	52,000 (100)
1987	19,400 (35.1)	10,000 (18.1)	16,600 (30.0)	6,800 (12.2)	2,600 (4.6)	55,400 (100)
1988	20,500 (33.1)	12,100 (19.5)	18,000 (28.9)	7,800 (12.6)	3,700 (5.9)	62,100 (100)
1989	22,300 (33.5)	14,300 (21.4)	17,600 (26.4)	8,500 (12.7)	4,000 (6.0)	66,700 (100)
1990	22,000 (34.9)	12,900 (20.4)	16,700 (26.4)	8,000 (12.7)	3,500 (5.5)	63,100 (100)
1991	20,400 (35.4)	11,800 (20.4)	15,700 (27.2)	6,800 (11.8)	3,000 (5.2)	57,700 (100)
1992	22,100 (35.7)	11,500 (18.6)	17,600 (28.4)	7,000 (11.3)	3,700 (6.0)	61,900 (100)
1993	21,900 (36.3)	10,500 (17.4)	17,300 (28.7)	6,800 (11.3)	3,800 (6.3)	60,300 (100)
1994	20,900 (35.3)	10,300 (17.5)	17,000 (28.7)	7,100 (12.0)	3,800 (6.5)	59,100 (100)
1995	22,300 (36.5)	10,200 (16.7)	17,100 (28.0)	7,300 (12.0)	4,100 (6.8)	61,000 (100)
1996	22,800 (35.0)	11,800 (18.1)	18,000 (27.6)	7,900 (12.1)	4,700 (7.2)	65,200 (100)
1997	22,600 (33.9)	12,200 (18.3)	17,800 (26.8)	8,800 (13.3)	5,100 (7.6)	66,500 (100)

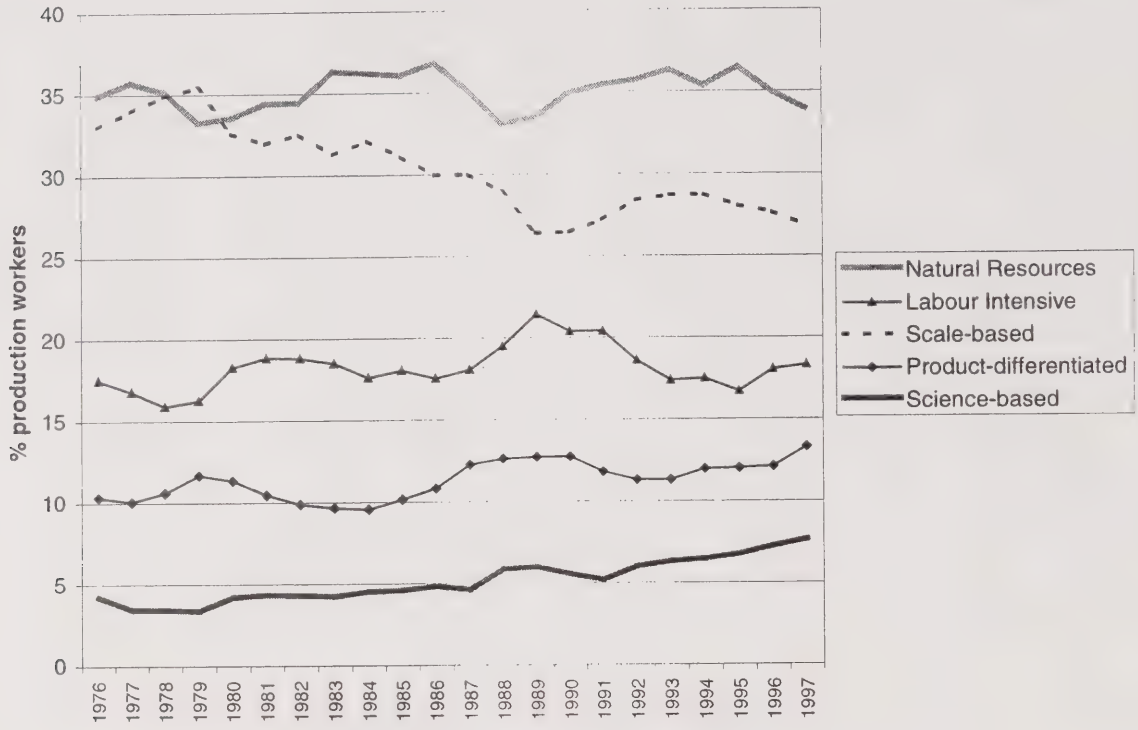
Note: (1) Employment totals may vary slightly from previously published totals due to data revisions. Numbers are rounded to protect the confidentiality of respondents.
(2) Numbers may not add due to rounding.
(3) Vancouver is defined using census divisions rather than by the standard CMA definition.

Table 11. Top 10 Industries by Employment in Vancouver, 1976-1996

SIC	Description	Sector	1976	1986	1996
2512	Sawmill and Planing Mill Products	Scale	1	1	1
2819	Other Commercial Printing Industries	Scale	7	3	2
1011	Meat and Meat Products Industry	Natural	6	2	3
1699	Other Plastic Products Industries	Natural	-	-	4
1021	Fish Products Industry	Natural	4	4	5
2839	Other Publishing Industries	Natural	-	-	6
2841	Newspaper, Magazine and Periodical Industry	Scale	3	5	7
3199	Other Machinery and Equipment Industries, n.e.c.	Product	-	-	8
3192	Construction and Mining Machinery and Materials Handling Equipment Industry	Product	9	-	9
3081	Machine Shop Industry	Product	-	-	10
3359	Other Communication and Electronic Equipment Industries	Science	-	6	-
2522	Softwood Veneer and Plywood Industry	Natural	2	7	-
1041	Fluid Milk Industry	Natural	-	8	-
2442	Women's Sportswear Industry	Labour	-	9	-
3271	Shipbuilding and Repair Industry	Scale	5	10	-
1072	Bread and Other Bakery Products Industry	Natural	8	-	
3351	Telecommunications Equipment Industry	Science	10	-	-

Note: Natural=Natural Resources, Labour=Labour Intensive, Scale=Scale-based, Product=Product Differentiated, Science=Science-based. Vancouver is defined using census divisions rather than the standard CMA definitions.

Figure 5. Changing Composition of Manufacturing Employment in Vancouver, 1976-1997



3.2.4 Summary

In summary, Toronto, Vancouver and Montreal are important to manufacturing in the province within which they are situated, as well as to Canadian manufacturing as a whole. However, the relative importance of each has changed. Montreal has become relatively less important, both within Quebec and nationally, as it has a manufacturing sector that is in a state of decline, with the exception of the science-based industries. Toronto, on the other hand, has continued to maintain its position of manufacturing dominance both within Ontario and Canada. This can be attributed to growth in the automotive sector, as well as other scale-based and natural resource industries. While Vancouver remains as a smaller manufacturing centre nationally, it—like Toronto—has grown and remains important to British Columbia and Canada's manufacturing sectors. Given the character of the industrial landscape of each of these city-regions, the performance of each of these economies, its level of concentration and/or specialization, and whether this affects the level of structural adjustment and industrial change experienced by each is now discussed.

4. Comparing the Industrial Trajectories of Three City-Regions

The success of these regions can be gauged both in terms of the quantity and quality of jobs in these regions.[4] Employment growth rates are used to measure the changing quantity of jobs in these regions. Relative wage rates are used as a proxy for the quality of jobs in these regions; it is assumed that average wage rates reflect the economic health of these regions. In this part of the analysis, the employment growth rates and relative wage rates across the natural resources, labour intensive, scale-based, product differentiated, and science-based sectors are discussed. Differences in the relative wage rates of production and non-production workers are also examined to assess the performance of manufacturing in each city-region. In addition, a number of industrial diversification and concentration measures are used to characterize the similarities and differences in the paths of industrial development for these city-regions. These differences and the trends therein are then compared to changing levels of volatility in labour markets.

4.1 Growth and Change in Toronto, Montreal, and Vancouver

4.1.1 Employment Growth

In this section, the employment dynamics of the Toronto, Montreal, and Vancouver city-regions are compared to the performance of manufacturing in Canada as a whole. The extent of employment changes in each city can be examined by measuring short-term or long-run employment gains or losses. The annual rate of employment growth reflects year-over-year, or short-term, employment gains whereas a compound index measuring employment relative to a given base year is used to illustrate long-run employment gains.[5]

The average rates of annual manufacturing employment growth in Toronto and Vancouver were 1.3% and 1.4% respectively, compared to -0.8% in Montreal and 0.6% nationally. However, as demonstrated in the previous section, there are cyclic growth patterns related to larger macro-economic forces (Figure 6). The impact of the early 1980s recession is evident in negative annual growth rates experienced in all three city-regions, although overall Vancouver had a higher rate of decline and a longer recovery period. The 1990s recession was experienced most in Montreal. During this second recession period, Vancouver was able to recover much more quickly than its eastern counterparts. During the growth period in the 1980s, Montreal exhibited lower levels of growth compared to either Toronto or Vancouver. Toronto experienced high levels of growth in the 1980s and returns to high levels of growth in the mid-1990s. Vancouver's growth rates experienced greater fluctuations suggesting greater volatility in the Vancouver economy. This cyclic pattern of growth and decline is similar though not identical across the various manufacturing sectors in Toronto, Montreal, and Vancouver (Appendix 3). Moreover, the cyclic pattern of economic development and differences in the short-term growth rates of these city-regions are reflected in the long-run outcomes of employment in these three regions (Figure 7). Similar trends are seen across the various sectors of manufacturing, with Vancouver exhibiting high levels of long-run growth in the labour intensive, product-differentiated and science-based industries (Appendix 4).

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[4] Throughout this section, all measures reflect production workers only.

[5] In this case, the base year is set equal to 1986, which is in the middle of the study period.

Figure 6. Annual Rates of Employment Growth in Toronto, Montreal and Vancouver, 1977-1997

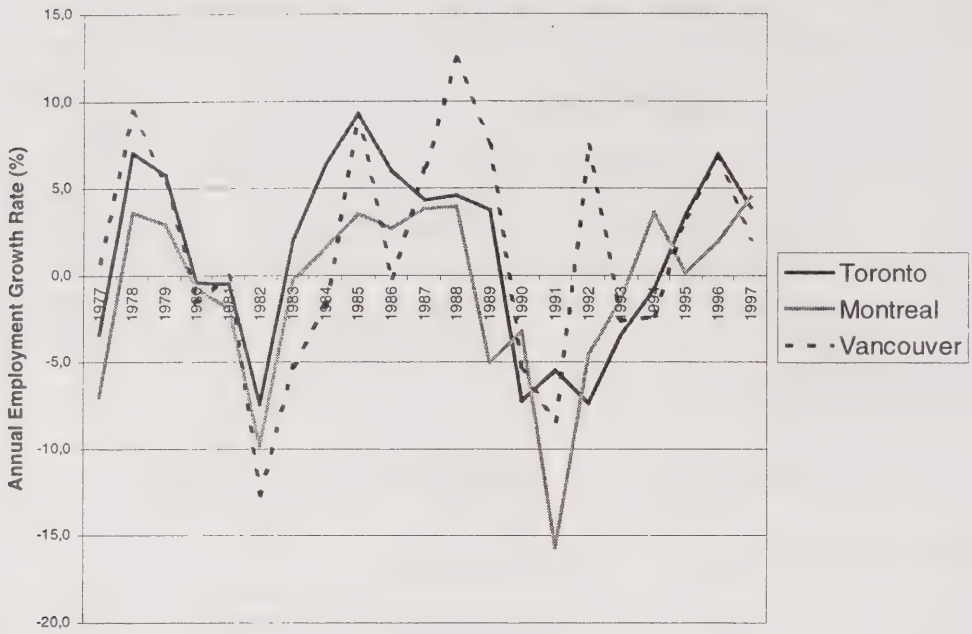


Figure 7. Employment Change in Manufacturing (1986=100) in Toronto, Montreal and Vancouver, 1976-1997

The study period was divided into four equal periods that closely approximate the cyclic pattern in annual growth rates observed in Figure 6 (Table 12). Between 1977 and 1982, there was very little overall growth in manufacturing employment, with Montreal experiencing decline. This reflects the slowing of the economy during that time, as well as the early 1980s recession. All three city-regions experienced employment growth between 1983 and 1987, but only Toronto exceeded the national average. The 1990s recession is reflected in the negative growth of Toronto and Montreal, both of which declined more than the national average. It is also important to note that Vancouver was not affected in the same way and in fact grew during this period. Differences between Vancouver and its eastern counterparts may reflect differences in the local and international markets in which they are involved. In the mid- to late-nineties, all three regions again experienced growth but all three regions had growth rates lower than the national average.

Table 12. Average Annual Employment Growth Rate, 1977-1997

	1977-97	1977-82	1983-87	1988-1992	1993-1997
Toronto	**1.3**	0.2	5.6	(2.3)	2.0
Montreal	**(0.8)**	(2.2)	2.3	(4.9)	1.7
Vancouver	**1.4**	0.2	1.6	2.7	1.4
Canada	**0.6**	(0.8)	3.2	(2.5)	2.7

Note: Cities are defined using census divisions rather than the standard CMA definitions.
Averages are calculated as the arithmetic mean of growth rates in each period.

At the sectoral level, there are differences in the average annual rates of employment growth (Table 13). Most notably, Montreal was in a state of decline or stagnation in all sectors, except for the science-based sector, where it experienced high growth rates. Also of interest is the high average rate of decline in Montreal's labour intensive sector. Toronto experienced strong growth in the natural resources and scale-based sectors, but its growth rate in the science-based sector was below the national average. Despite overall national decline in the labour intensive industries, Toronto exhibited some growth, although the average annual growth rate in this sector was very low. Unlike its eastern counterparts, Vancouver had high rates of growth in the labour intensive industries. Moreover, Vancouver's growth rate in the science-based industries is more than double that of Montreal's and of Canada's as a whole. This is commensurate with the findings presented earlier in this paper, which indicate that Montreal's manufacturing economy has declined whereas Toronto and Vancouver continue to experience growth.

Table 13. Average Annual Employment Growth Rate by Sector

	All Sectors	Natural Resources	Labour Intensive	Scale-based	Product Differentiated	Science-based
Toronto	**1.3**	1.7	0.2	2.0	1.5	1.2
Montreal	**(0.8)**	(0.2)	(2.4)	(0.6)	0.2	2.2
Vancouver	**1.4**	1.2	1.9	0.4	3.0	5.0
Canada	***0.6***	*1.0*	*(0.7)*	*0.6*	*1.6*	*1.7*

Note: Cities are defined using census divisions rather than the standard CMA definitions.

4.1.2 Volatility and Variation in Employment Growth

As seen previously, there is considerable variation in the annual growth rates of these city-regions (Figure 6; see also Appendix 3). Variation in annual growth rates is due to changes in national macroeconomic conditions, as well as region-specific factors. This volatility in annual growth rates affects the economic health and well being of businesses and labour markets in these cities. As noted earlier, Vancouver's annual growth rates appeared to fluctuate more than Toronto or Montreal's, suggesting higher levels of volatility. To measure this volatility, the variance (σ^2) in annual growth rates is calculated (Table 14).

Table 14. Variance of Annual Employment Growth Rates in the Manufacturing Sector

	All Sectors	Natural Resources	Labour Intensive	Scale-based	Product Differentiated	Science-based
Toronto	**27.9**	24.9	49.5	29.2	73.3	49.3
Montreal	**27.5**	22.7	31.4	49.6	51.6	76.4
Vancouver	**41.5**	29.9	95.8	45.7	114.6	196.3
CANADA	**20.7**	14.8	32.5	16.9	58.7	41.1

Note: Cities are defined using census divisions rather than the standard CMA definitions.

Overall, Vancouver has the highest variance in its employment growth rate; Montreal and Toronto's are lower and relatively similar. However, using an F-test (95% confidence level) reveals that the difference is not statistically significant. Vancouver exhibits higher volatility across all sectors with the exception of the scale-based sector. Lower volatility in Montreal is primarily because of the lower variance in its two highest employment sectors—the labour intensive and natural resource sectors. Toronto's lower level of variability can be attributed to low volatility in its two most dominant sectors—the scale-based and natural resource sectors. All three cities exhibit higher levels of volatility compared to Canada as a whole. The variance in growth of the total national economy is much lower than that for particular, local places. While variation in these three cities can be attributed to localized economic phenomena and the particularities of the markets to which they are tied, these effects are dampened in examining the national economy. At this larger scale, regional and local effects are balanced off against each other.

The natural resources and scale-based sectors are generally among the least volatile of all sectors in each city. In Montreal and Vancouver, the product-differentiated and science-based sectors were the most volatile. Again, an F-test (95% confidence level) was performed to determine whether these rates of volatility were significantly different from each other. The results indicate that only the volatility in Vancouver's science-based industries is statistically different from the rates of volatility experienced in the other two cities and in Canada. Additionally, the difference between the volatility of Vancouver and Montreal in the labour-intensive sectors is statistically significant. None of the other differences is statistically significant.

It is often felt that diversified economies are less susceptible to economic shocks and recessions (Malizia and Ke, 1993). Implicit in this argument is the assumption that a diversified economy is one where declines in some industries are offset by growth in others, therefore minimizing the

volatility of the economy. In other words, the growth rates of the various sectors are asynchronous. To examine this question and its underlying assumptions, a correlation matrix of the growth rates between the five manufacturing sectors discussed in this paper (natural resources, labour intensive, scale-based, product-differentiated, science-based) is constructed for each of Toronto, Montreal, and Vancouver. There is a strong positive correlation between the growth rates of the different sectors within each of these three city-regions; this is especially true of Toronto (Appendix 5). Growth rates are highly correlated between sectors in each of Montreal and Vancouver's manufacturing economies except for the science-based industries, where there are lower levels of correlation with other sectors. However, the degree of correlation across sectors is generally similar in each city. Differences are not statistically significant. This indicates that the individual manufacturing sectors in each of these cities are generally equally synchronized in terms of their growth and decline.

4.1.3 Employment Growth by Sector

The amount of growth and decline in the five broad sectors discussed in this paper is the result of the performance of each of the particular industries comprising the sector[6]. In the natural resource sector, the growth experienced in both Toronto and Vancouver can be attributed to growth in the food and plastics industries. Both Toronto and Vancouver experienced employment growth in the food industry that was higher than the national average (Table 15). All three city-regions experienced high growth in the plastics industry, although Montreal's growth rate was well below the national growth rate. Toronto maintained almost a 40% share of employment in the plastics industry in Canada.

Table 15. Employment Change in Selected Industries in the Natural Resource Sector

	Food Industry[1]			Plastics Industry[2]		
	1976-78	1995-97	% change	1976-78	1995-97	% change
Toronto	21,400	28,100	31.7	9,100	19,400	113.0
Montreal	17,700	14,000	(20.8)	3,600	7,100	95.6
Vancouver	7,500	10,300	37.4	800	3,100	274.2
Canada	*131,200*	*148,000*	*12.7*	*21,800*	*50,200*	*130.7*

Note: Cities are defined using census divisions rather than the standard CMA definitions. Employment numbers reflect average production worker employment over the three-year periods 1976-1978 and 1995-1997. Totals may not match previously published numbers due to data revisions. Numbers are rounded to protect the confidentiality of respondents. [1]Defined as all industries in major industry group 10 (food). [2]Defined as all industries in major industry group 16 (plastics).

Montreal experienced a significant decline in employment in the labour intensive industries throughout the study period with an average decline of 2.4% per year. In contrast, Toronto experienced a very low growth rate of 0.2% per year and Vancouver grew an average of 1.9% per year. Growth and decline in this sector can be attributed to the decline of the clothing and textiles industries; this is especially the case in Montreal (Table 16).

[6] The average growth rates quoted in this section can be found in Appendix 3.

Table 16. Employment Change in Selected Industries in the Labour Intensive Sector

	Primary Textiles and Textile Products Industries[1]			Clothing Industry[2]		
	1976-78	1995-97	% change	1976-78	1995-97	% change
Toronto	5,200	5,300	1.9	16,100	11,900	(26.2)
Montreal	11,200	8,700	(22.8)	47,900	26,300	(45.1)
Vancouver	700	1,200	74.8	2,400	3,100	29.2
Canada	*51,200*	*38,900*	*(24.1)*	*103,500*	*68,400*	*(33.9)*

Note: Cities are defined using census divisions rather than the standard CMA definitions Employment numbers reflect average production worker employment over the three-year periods 1976-1978 and 1995-1997. Totals may not match previously published numbers due to data revisions. Numbers are rounded to protect the confidentiality of respondents. [1]Defined as all industries in major industry groups 18 (primary textiles) and 19 (textile products), except for the contract textile dyeing and finishing industry (SIC 1992) which is classified as a natural resource industry in this study. [2]Defined as all industries in major industry group 24 (clothing industries).

In the scale-based industries, the Toronto region led the way with an average annual growth rate of 2.0%, compared to decline in Montreal (-0.6%) and minimal growth in Vancouver (0.4%). One of the largest engines of growth in the Toronto region is the automotive industry, or more broadly, the transportation equipment industry. The transportation industry grew by slightly more than 32% across Canada between 1976 and 1997; in Toronto, the growth rate was slightly less than double the national growth rate (Table 17). Scale-based industries in Vancouver are dominated by industries in, or related to, forest products.

Table 17. Employment Change in Selected Industries in the Scale-based Sector

	Transportation Equipment[1]		
	1976-78	1995-97	% change
Toronto	32,700	53,200	62.6
Montreal	6,800	5,800	(15.6)
Vancouver	3,400	1,800	(48.2)
Canada	*120,500*	*159,200*	*32.1*

Note: Cities are defined using census divisions rather than the standard CMA definitions Employment numbers reflect average production worker employment over the three-year periods 1976-1978 and 1995-1997. Totals may not match previously published numbers due to data revisions. Numbers are rounded to protect the confidentiality of respondents. [1]Defined as all industries in major industry groups 32 except for the aircraft and aircraft parts (SIC 3211), motor vehicle fabric accessories (SIC 3257), and boat building and repair industries (SIC 3281), which are not classified as scale-based industries in this study.

As previously discussed, product-differentiated industries play a lesser role in these regions. This sector has not exhibited the same levels of growth or decline witnessed in other sectors of these city-regions. Both Toronto and Vancouver experienced average annual rates of growth of 1.5% and 3.0% respectively in this sector, whereas Montreal experienced a very low growth rate (0.2).

The science-based sector experienced employment growth in all three city-regions, as well as nationally. While Montreal experienced decline or minimal growth in other sectors, it had an average growth rate of 2.2% annually in the science-based sector, above the national average. While this is lower than Vancouver's growth rate (5.0%), it is higher than Toronto (1.2%).[7] This is the

[7] Caution should be used in interpreting Vancouver's growth rate, since employment in this sector is very low.

only sector in Toronto where the region experienced an average annual growth rate that was not on par or above the national average. As seen earlier, growth in Montreal can be attributed to the growth in the aerospace and electronics industries (Table 18).

Table 18. Employment Change in Selected Industries in the Science-based Sector

	Communications and Electronic Equipment[1]			Aircraft and Aircraft Parts[2]		
	1976-78	1995-97	% change	1976-78	1995-97	% change
Toronto	7,300	9,900	36.3	5,100	7,000	36.7
Montreal	5,400	9,300	73.9	6,700	11,200	67.2
Vancouver	800	1,600	98.0	100	800	483.8
Canada	*22,500*	*39,500*	*75.4*	*15,400*	*26,600*	*73.3*

Note: Cities are defined using census divisions rather than the standard CMA definitions. Employment numbers reflect average production worker employment over the three-year periods 1976-1978 and 1995-1997. Totals may not match previously published numbers due to data revisions. Numbers are rounded to protect the confidentiality of respondents. [1]Defined as the telecommunications equipment (SIC 3351), electronic parts and components (SIC 3352), and other communications and electronic equipment (SIC 3359) industries. [2]Defined as the aircraft and aircraft parts industry (SIC 3211).

In summary, there has been a cyclic pattern of growth and decline that has been experienced to some degree across all sectors in these three city-regions. Overall, high growth was experienced in the natural resource industries in Toronto and Vancouver. Montreal experienced decline in its labour intensive sector, whereas Vancouver experienced growth. Toronto exhibited growth in the scale-based industries driven by the automotive sector. Again, this may reflect the differences in the markets that each city serves. Toronto is heavily tied to the U.S. market whereas Vancouver is linked to the Pacific Rim economy. All three cities experienced growth in the science-based industries, but this was more pronounced in Montreal and Vancouver.

4.2 Wage Rates in Three Canadian City-Regions

In this section, the quality of the jobs provided by manufacturing in these cities is examined. Relative wage rates are used to measure the economic success of the manufacturing sector in Toronto, Montreal, and Vancouver and are calculated as the ratio between wages per worker in a city-region compared to the wages per worker in the nation as a whole. If wage rates are higher than the national average, then the value of this ratio will be greater than one. In this section, we report both unadjusted and CPI-adjusted[8] relative wage rates. Changes in relative wages can reflect differences in industrial structure, skill levels, and demand within labour markets.

[8] The city-specific Consumer Price Index is used to deflate earnings in each city and the national Consumer Price Index is used to deflate national totals. CPI-adjusted real wages were used to calculate relative real wages. This accounts for changes in the cost of living between these cities. However, differences in the levels of relative wage rates may reflect differences in the cost of living as well as other factors.

The trends in relative wages rates for both the CPI-adjusted and unadjusted relative wage rates are very similar (see Figures 8 and 9). The relative wage rates of production workers in Toronto and Montreal remained quite stable throughout the study period, with Toronto maintaining higher wage rates than Montreal. Montreal's relative wage rates remained below the national average throughout the study period. Toronto's relative wage rates experiences were slightly below the national average until the mid-1990s when they were on par with the Canadian average. Production workers in Vancouver had wage rates that were substantially higher until the early 1980s, when relative wage rates for production workers began to decline and converge to a similar level as that experienced in Toronto. The decline and subsequent convergence of Vancouver's relative wage rates with Toronto's in the mid-1980s coincides with the time at which there was substantial growth in the Vancouver economy. The implication arising from these results is that changes in relative wage rates are not driven by changes in the cost of living. However, differences in the levels of relative wage rates may reflect differences in costs of living, as well as other factors such as production costs and industrial structure.

To examine whether or not this trend was driven by differences in industrial structure, relative wage rates (adjusted and unadjusted) were calculated across the five sectors of the manufacturing economy (see Appendices 6 and 7). The science-based sector was the only sector that did not follow the trend seen in the overall manufacturing economy. In the science-based sector, relative wage rates in these three regions were similar at the beginning of the study period but diverged beginning in the mid-1980s. Unlike the experience in other sectors, Montreal's relative wage rates increased throughout the study period and were above those of Toronto throughout the study period. As was the case in other sectors, Vancouver experienced a decline in relative wage rates. However, in the science-based sector, Vancouver's wage rates were lower than the other cities. It is also interesting to note that in the labour intensive sector, Montreal's relative wage rates for production workers were much lower than in Toronto and Vancouver at the beginning of the period and suffered a steep decline throughout the study period. Thus, in addition to experiencing significant job loss, Montreal's labour intensive sector experienced steeply declining wage rates for the remaining workers in this sector.

These results suggest that, with few exceptions, industrial structure does not appear to have a significant influence on the observed differences in wage rates. To further verify that regional differences are not simply a function of industrial structure, average relative wage rates are compared to average relative wage rates after correcting for industrial structure (Table 19). The corrected average is derived by calculating the average relative wage rate for each industry sector weighted by employment. Since very few differences were observed between the unadjusted and CPI-adjusted relative wage rates, only the results for the unadjusted relative wage rates are reported here. The correction is made for the overall period, as well as for the beginning and end periods.

Table 19. Effect of Industrial Structure on Relative Wage Rates

	1976-1997		1976-1981		1992-1997	
	Uncorrected	Corrected	Uncorrected	Corrected	Uncorrected	Corrected
Toronto	0.98	0.99	0.97	0.99	1.00	1.01
Montreal	0.89	0.95	0.90	0.96	0.89	0.94
Vancouver	1.10	1.11	1.20	1.18	1.01	1.03

Note: Cities are defined using census divisions rather than the standard CMA definitions.

Figure 8. Relative Wage Rates for Production Workers in Toronto, Montreal and Vancouver, 1976-1997

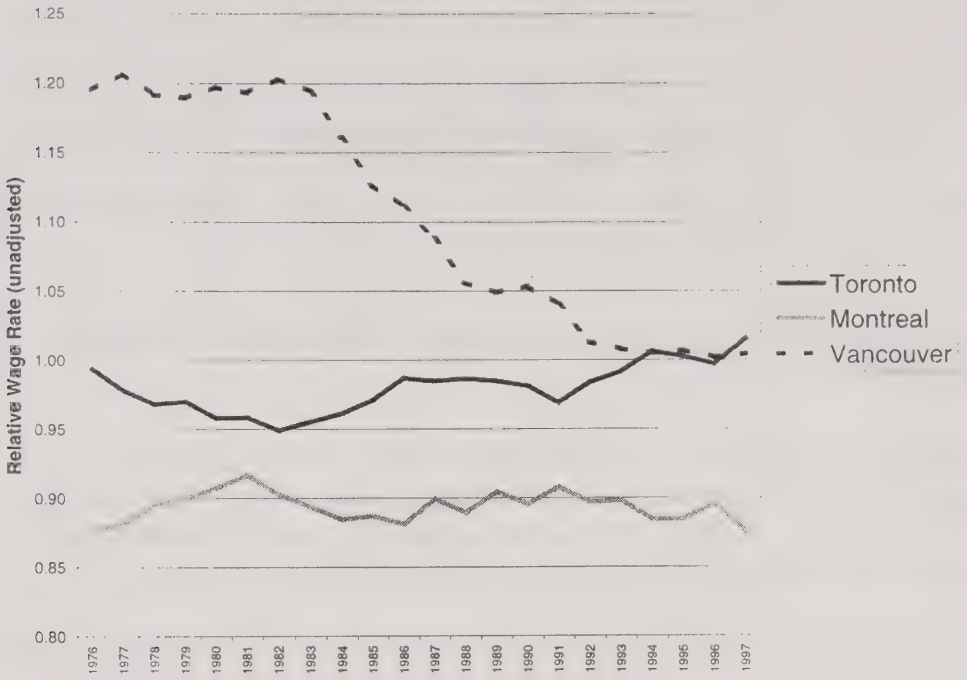
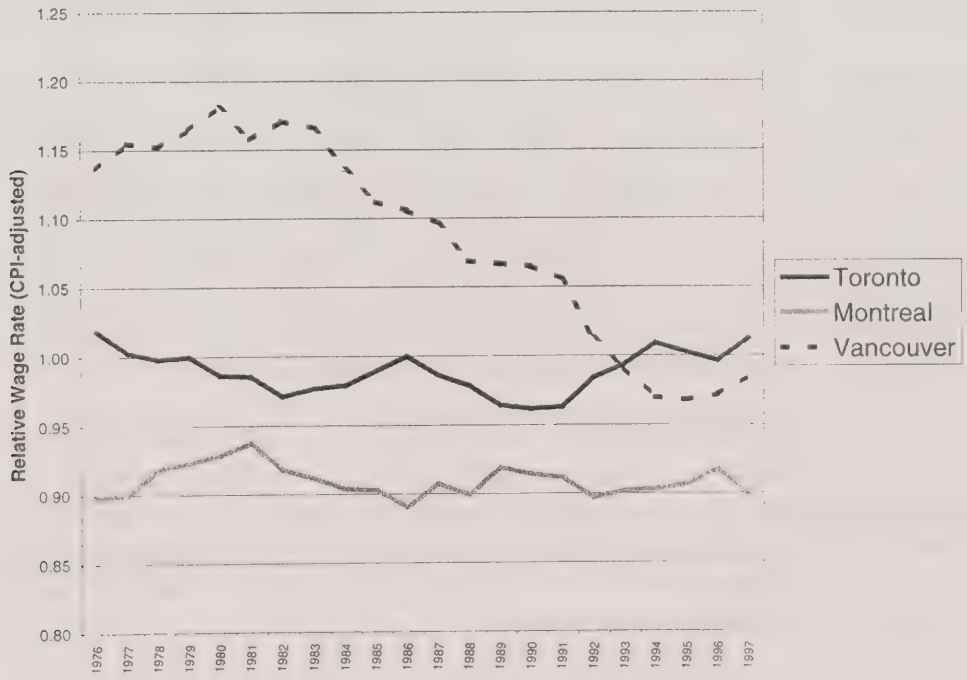


Figure 9. Relative Real Wage Rates for Production Workers in Toronto, Montreal and Vancouver, 1976-1997



Montreal's average relative wage rate increases, although it still remains below the national average. This suggests that industrial structure accounts for part of Montreal's lower wage rates. This is likely due to the low and declining wage rates of the labour intensive sector, which accounts for a high proportion of employment. The adjustment for industrial structure has little effect on the relative wage rates of Toronto and Vancouver. Toronto's wage rates remain close to the national average. Vancouver's wage rates remain high in the early part of the study period and fall to similar levels as Toronto in the later part of the study period. This suggests that other factors such as labour market demand, skill composition, and production costs, as well as differences in the markets to which these centres are tied, may be responsible for the differences and changes in Toronto and Vancouver, particularly the downward pressure on Vancouver's wages.

4.3 Concentration, Diversity, and Structural Adjustment in Toronto, Montreal and Vancouver

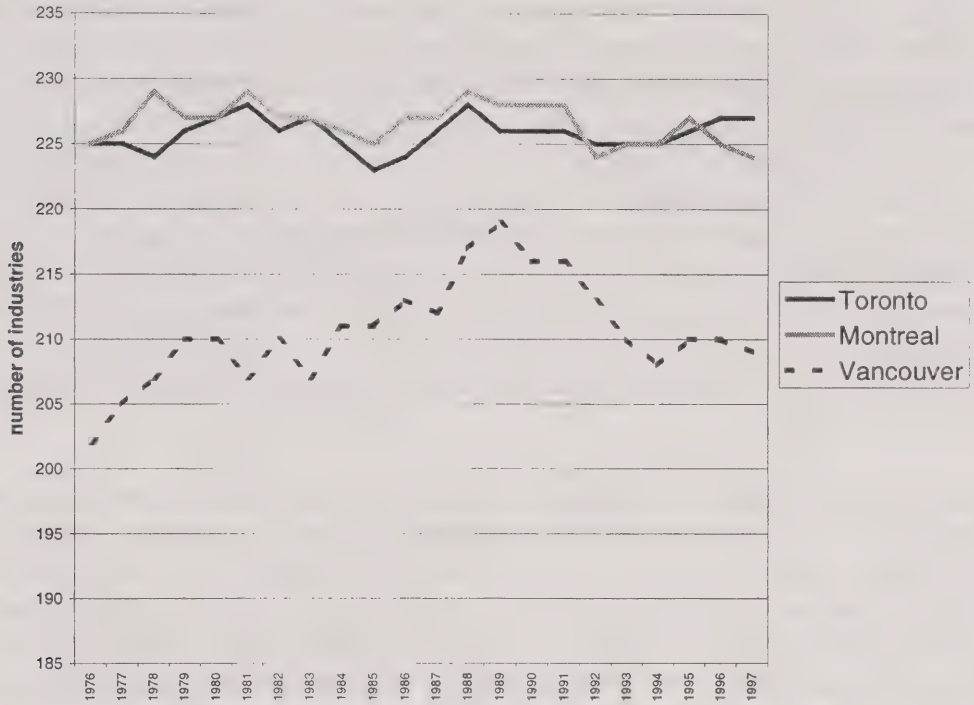
So far it has been established that there has been growth in the manufacturing activity of Toronto and Vancouver and a decline in Montreal's manufacturing sector, each of which is driven by particular sectors. This relative growth and/or decline has been investigated using average annual employment growth rates and the relative wage rates in these city-regions.

Since the success of these regions depends on the performance of particular industries, the emphasis given to individual sectors or its diversity across industries will affect the region's performance. Concentration of an industry's employment in rapidly growing sectors will result in rapid overall growth. Concentration in a less volatile sector or one whose growth is negatively correlated with growth in other industries may result in less overall volatility. This implies that industrial structure matters (i.e., the degree of concentration or the degree of diversity of a region), though exactly how it affects performance will depend upon the interaction of structure and performance.

There is considerable debate within the economics and geography literature as to whether diversification or specialization leads to growth in cities (Duranton and Puga, 2000; Feldman and Audretsch, 1999; Porter, 1998; Glaeser, et al., 1992; Jacobs 1969, 1984). It has been argued that having a more diversified economy spreads economic volatility over a number of sectors, therefore making these city-regions more immune to economic shocks. This last section of the paper explores whether or not there has been an increase in the level of manufacturing diversity or concentration in each of these cities. It also asks how the changing industrial structure has affected volatility. Finally, it examines the amount of structural adjustment experienced in these places by measuring the amount of employment share change occurring at the industry level.

The simplest measure of diversification is the number of industries (measured at the 4-digit SIC level) in each city-region. In the Montreal and Toronto city-regions, most of the possible 236 industries are represented. This indicates that their manufacturing economies are relatively diverse (Figure 10; see also Appendix 8). However, in Vancouver, there has been a substantial increase in the number of industries represented in the city-region. This suggests that the Vancouver economy has become more diverse over the study period.

Figure 10. Number of 4-digit Manufacturing Industries in Toronto, Montreal and Vancouver, 1976-1997



Measures of concentration indicate whether a region focuses on a relatively small number of industries or if the economy is diversified. The calculation of the two measures of concentration used in this paper relies on employment shares at the 4-digit industry level. The *Top Four Industry Concentration Index (Con4)* is defined as

$$Con4_i = \sum_{j=1}^{4} s_{ij} \qquad [1]$$

where s_{ij} is the share of industry j's employment in city i; this captures the percent of a city's total manufacturing employment accounted for by the four largest industries. During the study period, Vancouver's manufacturing sector became less concentrated whereas Toronto and Montreal have both experienced an increase in the level of concentration (Figure 11; see also Appendix 8). In 1976, Montreal's top four industries accounted for only 10% of employment; by 1997, they accounted for 18% of manufacturing employment in the region. Between 1976 and 1997, Toronto did not witness a significant change in the employment share of the top four industries. The top four industries in Vancouver accounted for 21% of manufacturing employment in 1976 and dropped to 18% by 1997.

While the *Top Four Concentration Index* considers only the high employment industries, the *Herfindahl Index (HI),* defined as

$$HI_i = \sum_{j=1}^{n} s_{ij}^2 \qquad [2]$$

considers the distribution of employment in the city-region across all industries; the closer a region's value is to 1, the more its employment is concentrated in one industry. The *Herfindahl Index* for each of the three cities changes throughout the study period (Figure 12; see also Appendix 8). Similar to the trend in the *Top four industry concentration index*, Vancouver experienced a decline in its level of industry concentration. Both Toronto and Montreal experienced an increase in the level of employment concentration during the study period. In the case of Montreal, this is due to the increasing relative importance of other industries, as the clothing and textiles industries decline; it can also be attributed to growth in some of the science-based industries, as discussed previously. Toronto's increased level of concentration can be attributed to the growth and development of the food and transportation equipment industries. In Vancouver, the measure reflects the maturing and development of the manufacturing sector within this region, including the addition of new industries. Both measures indicate that there is some convergence between the three regions through time and suggest that the path of industrial restructuring and change has been quite different between the older, established manufacturing city-regions (Toronto, Montreal) and the younger Vancouver city-region.

The effect of changing industrial concentration can be felt in several ways. A region may concentrate more of its output in industries that are less (or more) volatile, in which case overall volatility will tend to decrease (or increase). This can be thought of as a sectoral or own-industry effect. Moreover, a region may concentrate output in industries where growth is less (or more) synchronous with other industries, in which case overall volatility will decrease (or increase). This can be thought of as a portfolio effect. Thus, increasing concentration or less specialization can have quite different effects depending on the volatility of the sectors involved.

To investigate how changes in the level of manufacturing concentration or diversity has affected the volatility of these cities, the relationship between industrial structure and volatility is explicitly examined. The overall growth rate (g) in a city can be expressed as the sum of the growth rates across all sectors, weighted by employment size and is defined as

$$g_i = \sum_{j=1}^{n} w_j g_j \qquad [3]$$

where w_i is the share of employment in sector i and g_i is the employment growth rate in sector i. The overall volatility (the variance of the growth rate) of a city can be decomposed as the product of volatility of the sector and its employment weight (the square of its employment share), defined for two sectors as

$$\sigma^2(w_1 g_1 + w_2 g_2) = w_1^2 \sigma^2(g_1) + w_2^2 \sigma^2(g_2) + 2 w_1 w_2 \operatorname{cov}(g_1 g_2) \qquad [4]$$

As equation 4 indicates, there are two components that determine the variance of the growth of employment that arises from a region's combining together a diverse set of industries: 1) the sum of the variances associated with each particular industry sector, each weighted by its employment share, referred to here as the inherent sectoral volatility; and 2) the volatility associated with the interaction (or covariance) of the various sectors, referred to as the 'portfolio effect' in this paper.

Figure 11. Top Four Concentration Index in Toronto, Montreal and Vancouver, 1976-1997

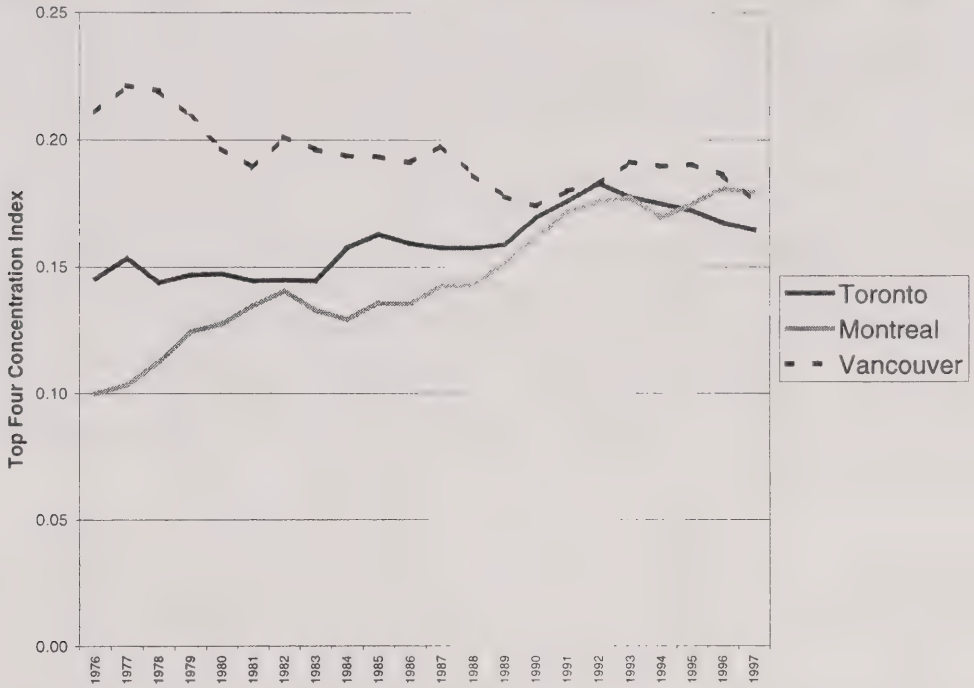
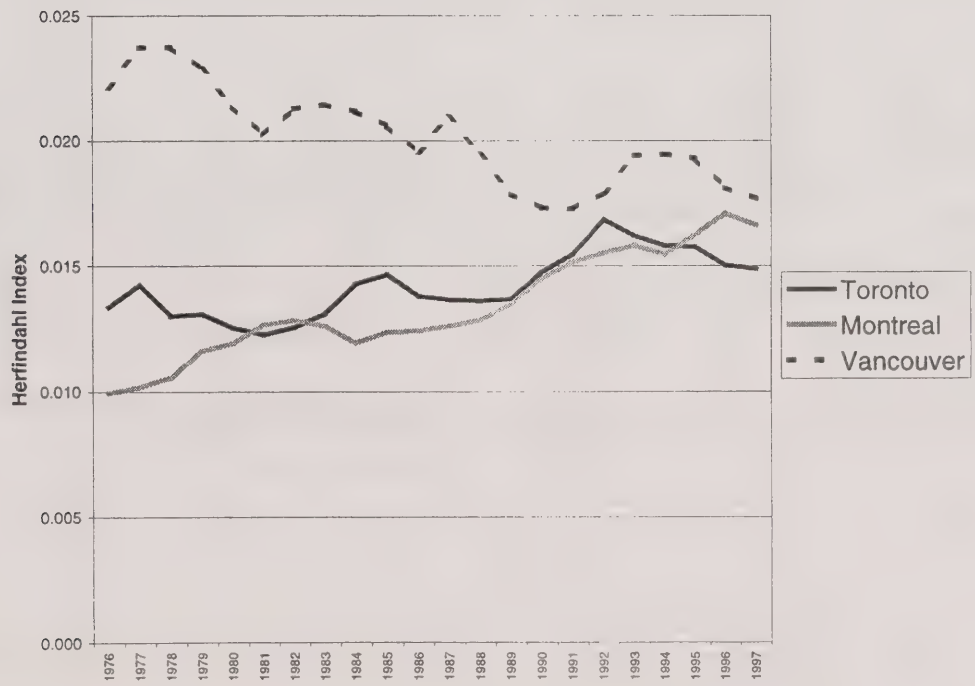


Figure 12. Herfindahl Index in Toronto, Montreal and Vancouver, 1976-1997



The evidence presented in this paper shows that there has been a change in the industrial mix in each of these cities throughout the study period. Changes in the industrial mix can affect both the inherent volatility term and the portfolio term. To estimate the effect of changing industrial structure, the employment shares of each of the five broad sectors discussed in this paper are used as the weights in equation 6, along with the average variance, to calculate how the change in volatility associated with each city-region is affected by the changing industrial structure (see Appendix 9).

Toronto and Montreal experience minimal declines in their volatility while Vancouver experiences a slight increase (Figure 13). It is also evident that Vancouver's level of volatility is much higher than either of its eastern counterparts throughout the study period. Vancouver's increase arises out of an increase in the portfolio (covariance) component. Reduced volatility in both Toronto and Montreal arises out of the own sector component, because of the increased importance and concentration in low volatility sectors in these cities (see Appendix 9). It is inferred from these results that changes in the level of diversity or concentration have had a negligible influence on the level of volatility in employment growth in these city-regions. Therefore, this suggests that diversification does not necessarily lead to less economic volatility as much of the literature assumes.

To further test the effect of industrial structure (or concentration) on economic volatility, the weighted employment (or industrial structure) of one city is substituted with that of the other cities (Table 20). Vancouver's volatility increases when the industrial structure of Toronto or Montreal is applied to it. This is mainly due to the small size of Vancouver's science-based economy and that sector's higher level of volatility. However, industrial structure and changes in that structure have only a small effect on the overall volatility of the manufacturing economy.

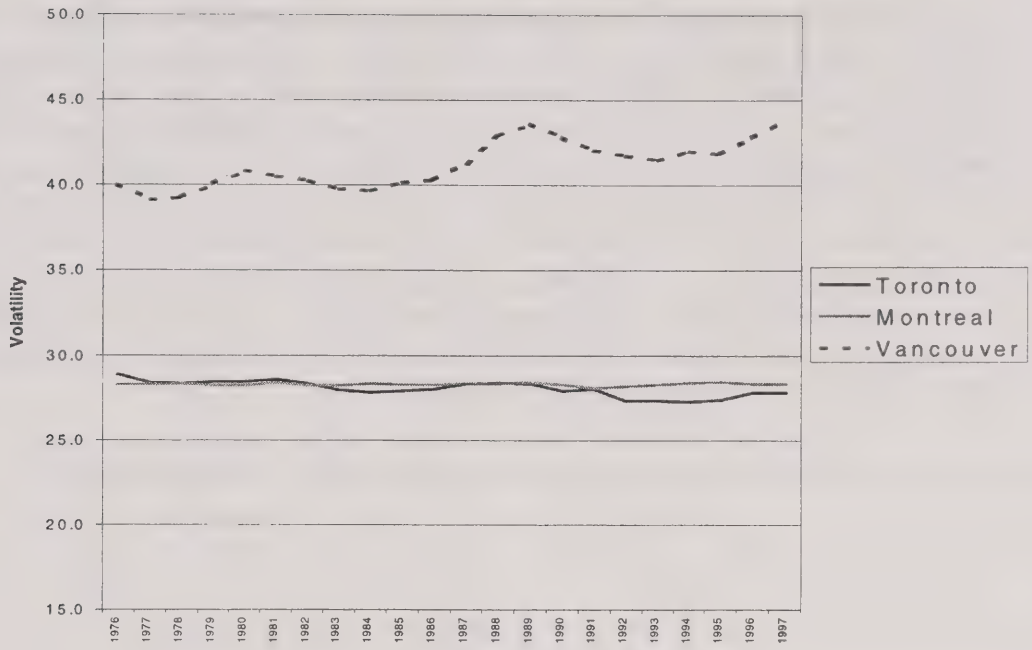
Once again, this provides evidence that increasing the level of diversification in a city-region does not necessarily result in lower levels of volatility. Having a diversified manufacturing economy may not lead to a more stable economy. Concentration in particular sectors can also be beneficial if it is in sectors with lower levels of volatility.

Table 20. Effect of Industrial Structure on Volatility, 1976-1997

Industry Structure	Own Variance			Portfolio Effect			Overall		
	Toronto	Montreal	Vancouver	Toronto	Montreal	Vancouver	Toronto	Montreal	Vancouver
Toronto (1976)	***8.5***	8.7	16.1	***20.3***	21.9	36.5	***28.8***	30.6	52.6
Toronto (1997)	***8.1***	9.1	14.7	***19.7***	21.2	34.8	***27.8***	30.3	49.5
Montreal (1976)	12.5	***9.5***	23.6	19.2	***18.8***	33.8	31.7	***28.3***	57.4
Montreal (1997)	9.3	***8.5***	19.1	20.3	***19.8***	38.7	29.6	***28.3***	57.8
Vancouver (1976)	8.6	9.8	***13.1***	17.7	20.1	***26.9***	26.3	29.9	***40.0***
Vancouver (1997)	8.2	8.6	***13.1***	18.9	20.7	***30.8***	27.1	29.3	***43.9***

Note: Cities are defined using census divisions rather than the standard CMA definitions.

Figure 13. Volatility Change in Toronto, Montreal and Vancouver, 1976-1997



The *Industry Share Change Index* (*ISC*) measures the total annual change in employment shares across all industries within a region in order to determine the level of industrial adjustment and restructuring that has taken place within each city-region's economy. It is defined as

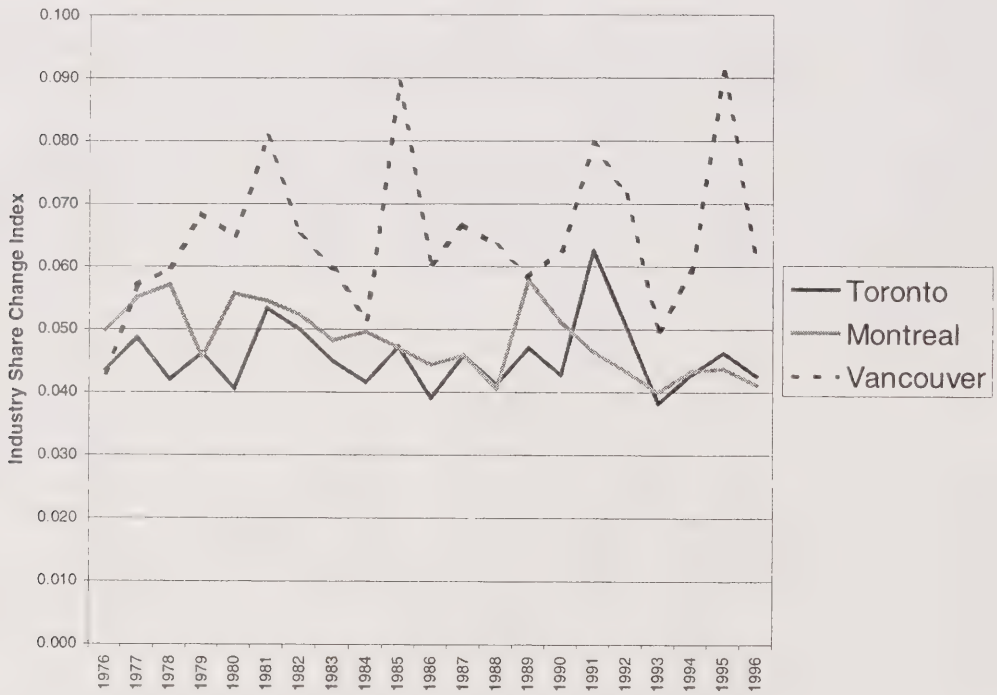
$$ISC_i = \sum_{j=1}^{n} \left| s_{ij,t+1} - s_{ij,t} \right| / 2 \qquad [5]$$

where t is the year and the sum of the differences in industry employment shares is divided by two to avoid double counting. This index calculates the change in employment shares between two adjacent time periods for all industries in a region. Changes in the *ISC* reflect both non-synchronous growth (e.g. short-run adjustments caused by fluctuations in the business cycle) and restructuring (e.g. long-run adjustments due to shifts in the economy). The *ISC* will generally move in the same direction as the volatility measures discussed previously. However, the change will not be exactly the same. A given increase in volatility will translate into a greater increase in the *ISC* when the growth rates between the largest and smallest industries diverge.

The level of adjustment and change across all three city-regions increased throughout the study period (Figure 14; see also Appendix 8). In 1991, there are notable peaks in both Vancouver and Toronto, indicative of the recession experienced across the Canadian economy at that time. A similar peak exists for Montreal, although recessionary pressures were felt slightly earlier. Overall, the Montreal economy experienced an annual share change of 3.5% to 5% during the study period. Throughout the late 1970s and 1980s, Toronto had lower levels of share change compared to Montreal. In the 1990s, Toronto experienced higher levels of annual share change. As with the variance of growth measure, the industry share change measure again shows that Vancouver experienced a higher (and increasing) level of adjustment than its eastern counterparts, with annual share changes between 4% and 8%.

In summary, the measures of diversity and change presented in this section indicate that there are some key similarities between Montreal and Toronto, both established manufacturing centres, that separate them from their western counterpart. Toronto and Montreal were less volatile, whether measured by the variance of growth rates or the amount of industry share that is reallocated across industries. Both cities experienced increasing levels of industrial concentration and slight declines in the volatility of their overall growths. However, it should be noted that there are some differences too, stemming from the relative growth of manufacturing in Toronto and the overall decline of manufacturing in Montreal. Toronto grows relative to Montreal and continues to have a more dynamic manufacturing sector; this is demonstrated in Toronto's long-run trend increase in the *Industry Share Change Index*. The story for Vancouver is different. Vancouver has decreasing levels of concentration and increased diversification throughout the period reflecting the development and maturing of the manufacturing economy in the region. It is inherently more volatile, even after the changes in its industrial structure are taken into account. Finally, it has undergone the most restructuring.

Figure 14. Industry Share Change Index in Toronto, Montreal and Vancouver, 1976-1996



5. *Conclusions and Future Directions*

Between 1976 and 1997, Canada's three largest city-regions accounted for a large proportion of manufacturing employment, shipments, plants and head offices. These three city-regions dominate the Canadian landscape and shape the success of the manufacturing sector in Canada. However, each city-region has followed its own unique path of industrial development, although some similarities between these cities have been noted—particularly between Montreal and Toronto, that historically have been traditional locations for manufacturing in Canada.

This study reveals that Montreal has been in a state of decline, especially in the labour intensive industries such as textiles and clothing that had dominated Montreal's industrial landscape in the early postwar period. Montreal has also done poorly in terms of relative wage rates. However, while Montreal has been in overall decline, there has been growth in the science-based manufacturing industries, something not seen to the same extent in Toronto. On the other hand, Toronto has experienced moderate growth throughout the period, increasing its concentration and specialization in transportation equipment industries. Vancouver's industrial trajectory and experience has followed a path separate from that of its eastern counterparts. While Vancouver's manufacturing sector exhibits higher levels of growth and change, it still maintains slightly less than a 5% share of manufacturing nationally. Vancouver's separate path to industrial development reflects historical differences and its links to the Pacific Rim, as well as the more recent vitalization of western Canada's economy.

Montreal and Toronto show less volatility than Vancouver. Moreover, structural change in Montreal and Toronto led to less diversity, while structural change in Vancouver increased diversity. This structural change had a negligible affect on the level of volatility in these city-regions. Both Montreal and Toronto also exhibited lower levels of industry-share adjustment than Vancouver, although Toronto and Vancouver exhibited increased adjustment toward the end of the period. These differences may reflect exogenous factors such as market fluctuations, since these cities are related to different local, regional and international markets.

This paper only begins to describe and examine the dynamics of manufacturing in Canada's most urbanized regions: Toronto, Montreal, and Vancouver. Further research is required to fully understand both the dynamics between and within these regions. Baldwin, Brown and Vinodrai (2001) note that there has been a decline across most sectors in the core of these metro areas coupled with an increase in the fringe areas. This raises the issues of how similar or different each of these city-regions is in terms of the relationship between its core and fringe. While some geographers have addressed the issue of the shifting location of manufacturing and other activities from the inner city to the periphery, it is unclear as to whether this shift occurs evenly across all cities or within all industries. Moreover, most of this work has been done in the American context; most research on urban Canada has indicated that Canadian cities and the Canadian urban system are dissimilar when compared with their American counterparts.

The employment dynamics are considered only in Canada's three largest urban centres in this paper. However, Canada's urban fabric extends well beyond the three city-regions discussed here. It would be useful to extend this analysis to the second and third tiers of Canada's cities including Ottawa,

Calgary, Edmonton, and Halifax, as well as others. Furthermore, the extension of this analysis to include other Canadian cities or city-regions would permit a number of other forms of analysis. For example, multivariate analyses could be conducted to find the correlates and determinants of growth, structural change, and productivity changes in Canadian cities (Coffey and Shearmur, 1998a, 1998b).

While this paper has considered the dynamics of industry sectors, this captures only part of the industrial dynamics taking place. An examination of the dynamism of manufacturing in these regions could also examine the entry and exit of firms into these areas, as well as the relocation of firms within these city-regions. Additionally, a study of job turnover in these regions could shed further light on, and understanding of, the dynamics and volatility of these areas (Baldwin and Rafiquzzaman, 1995).

It should also be noted, that while a high proportion of manufacturing is located in Canadian cities and their fringes, cities engage in other forms of economic activity. For example, each of the city-regions included in this study, also acts as a hub for critical financial and business services for both national and international markets (Coffey and Shearmur, 1998a; Coffey, 1996). Other cities are the focal points for particular regions. Therefore, a logical extension of this study is to include other non-manufacturing industry sectors in an examination of the extent to which Canadian cities have diversified or have become more specialized in particular industrial and business activities.

Appendix 1: A Method for Creating Consistent Geographic Units for Longitudinal Analysis

1. Background

Statistics Canada maintains a Standard Geographic Classification (SGC) system that provides a geographic framework for analysis. However, the geographic areas described by the SGC are updated every five years, concurrent with the Census of Population. These updates include significant boundary changes and can result in areas being reclassified. Thus, difficulties are encountered when conducting longitudinal analysis since the geographic unit of analysis does not remain constant through time. Therefore, a method for creating a consistent geographic framework is required. The objective of this exercise is to develop a method for assigning 1976 census geography identifiers to all records in a longitudinal database derived from the Annual Survey of Manufactures (ASM) between 1976 and 1997.

Responses to the ASM are collected at the plant level and each plant is assigned a unique identifier (RSN). Matching plant-level records by RSN enables the creation of a longitudinal file that tracks each plant through time. The ASM provides a location for each plant in a given year by ascribing it to a province, county, and municipality, which together comprise an internal coding system referred to as the Manufacturing Geographic Classification (MGC). The MGC is a revision of the SGC adopted by the ASM for operational purposes. Table A-1 outlines the differences between the two schemes.

The MGC is the same as the SGC at the province and county level, where the county (MGC) is equivalent to the SGC concept of a census division. The municipality (MGC) is similar, but not identical, to the SGC concept of a census subdivision (CSD).[9]

Census subdivisions undergo frequent and significant boundary changes that reflect Canada's changing political geography at the local level. However, census divisions remain more stable through time. Therefore, census divisions are used here as the unit of analysis since they provide detail at a sub-provincial level, have relatively stable and static boundaries[10], and bridge the differences between the two classification systems. The following section describes the methodology adopted for assigning all plants in the longitudinal file to a census division based on the 1976 census boundary definitions.

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[9] In the MGC, some municipalities are amalgamated whereas in the SGC they are treated as separate entities. Unlike coding for the province and county/census division, the actual codes used in the MGC are not the same as those used in the SGC.

[10] This is true across all of the provinces and territories, with the exception of Quebec. Census division boundaries were redrawn in the province of Quebec between 1986 and 1991 resulting in complete geographic discontinuity between these two census years.

2. *Method*

Given the possibility of shifts in geographic boundaries at the census division level, each plant in the longitudinal ASM file can have multiple geographic codes through time. Multiple geographic codes can arise from two possibilities: 1) the plant relocated[11] or 2) there is a change in the geographic structure. In the first instance, the longitudinal record for a plant that relocates (defined as a plant that changes province) was split into two records at the point when a change in province is detected. Once controlling for plant relocation, the second issue is addressed by assuming that the establishment's location in its entry year represents its location throughout the study period. However, this does not solve the problem completely. Using the geographic area assigned to an entrant in its year of birth may not result in consistent geographic units since the SGC changes every five years. For example, a plant entering in 1992 would be assigned to a census division using the 1991 census geography, which may not be consistent with the 1976 census geography.

The majority of plants existed (or entered) at the beginning of the study period and therefore were assigned a location using the 1976 census division definitions. Plants entering prior to 1981 were readily assigned to a 1976 census division since there were no boundary changes made prior to the 1981 Census. Only plants entering in 1981 or thereafter needed to have their location adjusted.

A process for assigning entrants (post-1981) to a consistent geographic structure based on the 1976 boundary definitions was developed by identifying all of the areas where there were census division boundary changes. Since the longitudinal file covers the period between 1976-1997, boundary changes between the 1976, 1981, 1986, 1991 and 1996 Censuses were examined using a geographic information system (GIS) package. This was used to identify changes in the spatial limits of census division boundaries. It was found that there were no significant changes in the geographic hierarchy at the census division level between the 1976 and 1981 Census. Therefore, adjustments only needed to be made to plants entering in 1986 and thereafter.

Boundary changes that have taken place at the census division level for each census year (1986 and beyond) were identified on a province-by-province basis since the census division also represents a sub-provincial level of political jurisdiction in most provinces. Based on these boundary changes, a set of rules for assigning 1976 census divisions to establishments entering in 1986 or thereafter were developed. The majority of the provinces and territories require no adjustments (Table A-2).[12] Rules were developed to address boundary changes in Quebec, Ontario, Alberta and British Columbia. In all other provinces and territories, regardless of year of entry, the assigned census division can be treated as the 1976-equivalent census division. Elsewhere, a number of strategies were used to generate 1976-

[11] In the ASM, a plant is assigned a new RSN if two of the three following conditions are met: a) there is a change in ownership; b) there is a physical relocation of the plant; and c) there are significant changes in the output of the plant resulting in industry reclassification. Therefore, not all plant relocations are accounted for in this exercise. Since this study is predicated upon the geographic location of plants, additional changes are made to improve locational accuracy.

[12] Some boundary changes were considered too small to make a difference. For example, census divisions in the Northwest Territories were redrawn but most of the reallocated area was part of Great Bear Lake. Other boundary changes included corrections to the cartography, as well as some municipal boundary changes. If census subdivision level data were available, some of these changes could have been implemented.

equivalent census divisions depending on whether census divisions were split, amalgamated, or otherwise changed. These strategies are described in detail in the following sections.

2.1 Census Division Splits

The first type of geographic change involves the splitting of census divisions after 1981. In this scenario, large census divisions are divided into two or more smaller census divisions (Figure A-1). This occurred in Alberta and British Columbia. Therefore, census divisions are adjusted for some entrants between 1986 and 1997 to account for the splitting and renumbering of census divisions (Table A-3).

2.2 Census Division Amalgamations

The second type of geographic boundary change involves the amalgamation of census divisions after 1981. In the absence of census subdivision level data, this is more problematic. It is difficult to assign a plant to an original census division, since there are multiple possibilities. Due to this limitation, this is the only case where 1976 boundaries are cast forward to their 1986 equivalent. There are only three areas in eastern Ontario where regional restructuring resulted in the amalgamation of census divisions (Table A-4; see for example Figure A2).

2.3 Census Division Restructuring—British Columbia and Quebec

The third type of geographic boundary change occurs when there are changes to census division boundaries that do not follow existing census division boundaries (Figure A-3). This type of geographic restructuring requires a different approach and is applied only to a portion of British Columbia and across all of Quebec.

In British Columbia, the boundaries in the Vancouver area were significantly redrawn between the 1986 and 1991 Censuses. Therefore, entrants between 1991 and 1997 in these areas could belong to a number of 1976-equivalent census divisions and—in the absence of census subdivision level data—it is difficult to identify to which 1976 census division they belong. Table A-5 shows the possible equivalents for each area where there were boundary changes. To overcome this problem, the postal code associated with each of the plants was used; this process is described in more detail below.

The problem is more extensive in Quebec. Census division boundaries across that province were significantly redrawn between the 1986 and 1991 Censuses. There were no major boundary changes between 1981 and 1986 in Quebec. Therefore, census divisions assigned to plants entering Quebec prior to 1991 can be used as the 1976-equivalent census division. The postal codes for all plants entering in Quebec in 1991 or thereafter were used to assign 1976-equivalent census divisions.

Postal code information for entrants in the specific regions of British Columbia (Table A-5) and Quebec was derived from a physical location file maintained by the ASM that tracks each plant location.[13] These postal codes were linked to geographic co-ordinates (latitude, longitude) using Statistics Canada's postal code conversion file (PCCF).[14] These geographic coordinates (with postal code identifiers) were then plotted using a desktop GIS package. These points were then overlaid with the 1976 Census Division boundaries to identify the 1976 Census Division in which they were located (Figure A-4).

It should be noted that there are some data quality issues associated with the physical location file. Some of the records had invalid postal codes or had postal codes that suggested the plants were located in another province or country. In this very small number of cases, an imputation method was used based on the census division assigned upon entry. That is, all other records that were assigned to that census division in that year were examined to identify their 1976-equivalent census division. The plant with the invalid postal code was then assigned a 1976-equivalent census division based on where the majority of the other plants in the same census division were allocated using the 1976 geographic structure.

In addition to data quality issues, there are some errors associated with using postal codes. Postal codes are most accurate within urban areas, where a postal code usually represents one side of a street block. In rural areas, postal codes can represent a wider area; therefore, the point location assigned to the postal code does not represent the exact physical location of that postal code (see Statistics Canada, 1997c). However, the probability of the postal code location being correct in rural areas increases when linked with larger areas (such as census divisions).

[13] While the physical location file could have been used to address some of the other problems described above, there are some issues regarding data quality. This is discussed in more detail below. The magnitude of this problem is minimised by using the postal code only after considering all other options.

[14] While the PCCF provides a link between each postal code and its position within the census geography, it is only linked to the most recent census geography. However, the PCCF also provides coordinate information that enables us to map these to other vintages of census geography.

Table A1. Comparison of Geographic Classifications

Standard Geographic Classification (SGC)	Manufacturing Geographic Classification (MGC)
Province	Province
Census Division (CD)	County
Census Subdivision (CSD)	Municipality

Table A2. Census Division Adjustments by Province

SGC Code	Province / Territory	Adjustments Required
10	Newfoundland	No
11	Prince Edward Island	No
12	Nova Scotia	No
13	New Brunswick	No
24	Quebec	Yes
35	Ontario	Yes
46	Manitoba	No
47	Saskatchewan	No
48	Alberta	Yes
59	British Columbia	Yes
60	Northwest Territories	No
61	Yukon Territory	No

Table A3. Census Division Adjustments for Splits and Renumbering

	Original SGC Code		1976 SGC Equivalent	
Entry years	Province	Census Division	Province	Census Division
1986-1997	48	17	48	15
1986-1997	48	18	48	15
1986-1997	48	19	48	15
1986-1997	48	15	48	09
1986-1997	48	08	48	08
1986-1997	48	09	48	08
1991-1997	59	59	59	55
1991-1997	59	55	59	55

Table A4. Census Division Adjustments for Amalgamations

Entry years	Original SGC Code		1986 SGC Equivalent	
	Province	Census Division	Province	Census Division
1976-1985	35	02	35	02
1976-1985	35	03	35	02
1976-1985	35	01	35	01
1976-1985	35	04	35	01
1976-1985	35	05	35	01
1976-1985	35	07	35	07
1976-1985	35	08	35	07

Table A5. Census Division Restructuring in British Columbia

Entry years	Original SGC Code		Potential 1976 SGC Equivalent	
	Province	Census Division	Province	Census Division
1991-1995	59	15	59	11
1991-1995	59	15	59	15
1996-1997	59	15	59	11
1996-1997	59	15	59	13
1996-1997	59	15	59	15
1996-1997	59	09	59	09
1996-1997	59	09	59	11
1996-1997	59	09	59	13

Figure A1. The Splitting of Census Divisions in Northern Alberta and British Columbia

Figure A2. The Amalgamation of Census Divisions in Eastern Ontario

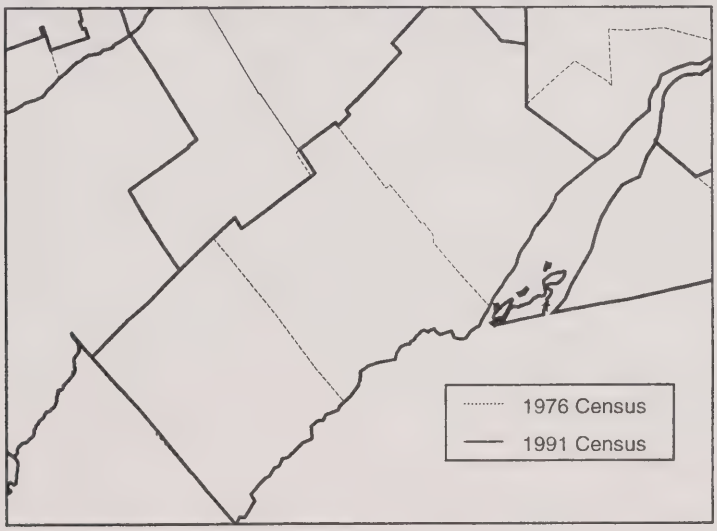


Figure A3a. Census Divisions in the Montreal Area Using the 1976 Boundary Definitions

Figure A3b. Census Divisions in the Montreal Area Using the 1991 Boundary Definitions

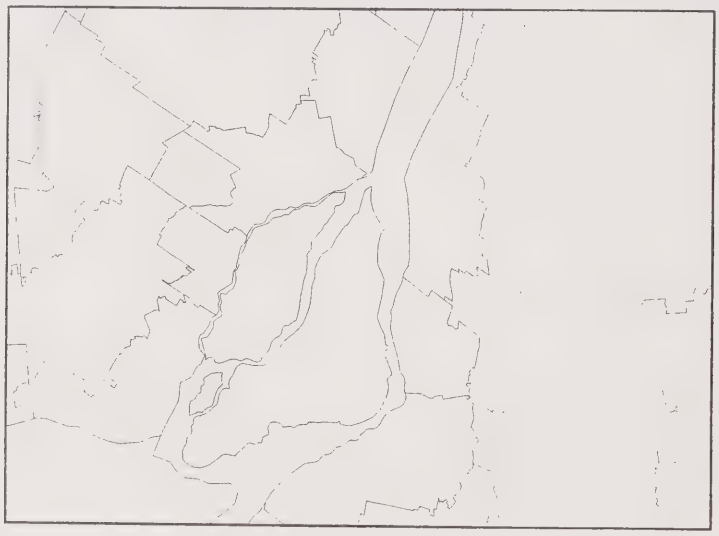
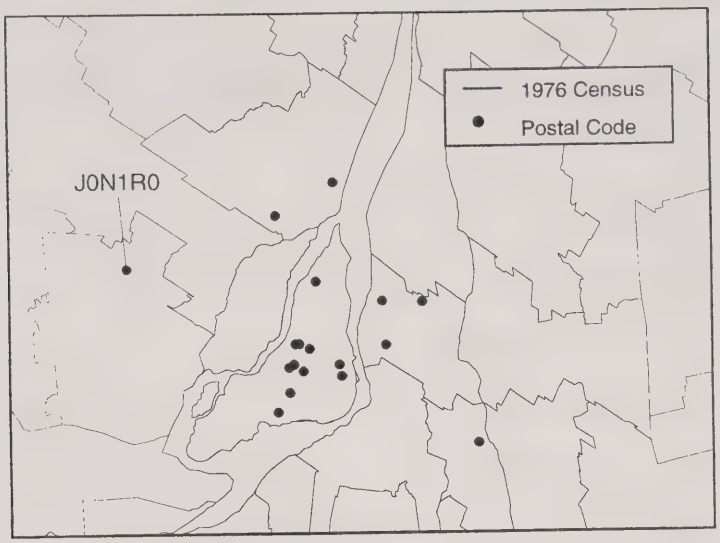


Figure A4. Plotting the Coordinates of Postal Codes to Assign them to 1976 Census Divisions in the Montreal Area



Appendix 2: Manufacturing Sector Taxonomy Using the 1980 Standard Industrial Classification

Natural Resources Sector	
1011	Meat and Meat Products (except Poultry)
1012	Poultry Products Industry
1021	Fish Products Industry
1031	Canned and Preserved Fruit and Vegetable Industry
1032	Frozen Fruit and Vegetable Industry
1041	Fluid Milk Industry
1049	Other Dairy Products Industries
1051	Cereal Grain Flour Industry
1052	Prepared Flour Mixes and Cereal Foods Industry
1053	Feed Industry
1061	Vegetable Oil Mills (except Corn Oil)
1071	Biscuit Industry
1072	Bread and Other Bakery Products Industry
1081	Cane and Beet Sugar Industry
1082	Chewing Gum Industry
1083	Sugar and Chocolate Confectionery Industry
1091	Tea and Coffee Industry
1092	Dry Pasta Products Industry
1093	Potato Chip, Pretzel and Popcorn Industry
1094	Malt and Malt Flour Industry
1099	Other Food Products Industries n.e.c.
1111	Soft Drink Industry
1121	Distillery Products Industry
1131	Brewery Products Industry
1141	Wine Industry
1211	Leaf Tobacco Industry
1221	Tobacco Products Industry
1611	Foamed and Expanded Plastic Products Industry
1621	Plastic Pipe and Pipe Fittings Industry
1631	Plastic Film and Sheeting Industry
1691	Plastic Bag Industry
1699	Other Plastic Products Industries n.e.c.
1711	Leather Tanneries
1992	Contract Textile Dyeing and Finishing
2511	Shingle and Shake Industry
2521	Hardwood Veneer and Plywood Industry
2522	Softwood Veneer and Plywood Industry
2541	Prefabricated Wooden Buildings Industry
2542	Kitchen Cabinet and Bathroom Vanity Industry
2543	Wooden Door and Window Industry
2549	Other Millwork Industries
2581	Coffin and Casket Industry
2592	Particle Board Industry
2593	Wafer Board Industry
2599	Other Wood Industries n.e.c.
2692	Hotel and Restaurant Furniture Industry
2699	Other Furniture and Fixture Industries n.e.c.
2791	Coated and Treated Paper Industry
2792	Stationery Paper Products Industry
2793	Paper Consumer Products Industry

2799 Other Converted Paper Products Industries n.e.c.
2831 Book Publishing Industry
2839 Other Publishing Industries
2951 Primary Production of Aluminum
2959 Other Non-ferrous Smelting and Refining
2961 Aluminum Rolling, Casting and Extruding
2971 Copper Rolling, Casting and Extruding
3511 Domestic Clay Products Industry
3521 Cement Industry
3541 Concrete Pipe Industry
3542 Structural Concrete Products Industry
3549 Miscellaneous Concrete Products Industry
3551 Ready-mix Concrete Industry
3581 Lime Industry
3591 Refractories Industry
3592 Asbestos Products Industry
3593 Gypsum Products Industry
3594 Non-metallic Mineral Insulating Material
3599 Misc. Non-metallic Mineral Products n.e.c.
3611 Petroleum Products (except Lubricating Oil, Grease)
3612 Lubricating Oil and Grease Industry
3699 Other Petroleum and Coal Products Industries
3971 Sign and Display Industry

Labour Intensive Sector

1712 Footwear Industry
1713 Luggage, Purse and Handbag Industry
1719 Misc. Leather and Allied Products Industries
1811 Man-made Fibre and Filament Yarn Industry
1821 Wool Yarn and Woven Cloth Industry
1829 Misc. Spun Yarn and Woven Cloth Industries
1831 Broad Knitted Fabric Industry
1911 Natural Fibres and Felt Products Industry
1921 Carpet, Mat and Rug Industry
1931 Canvas and Related Products Industry
1991 Narrow Fabric Industry
1993 Household Products of Textile Materials
1994 Hygiene Products of Textile Materials
1995 Tire Cord Fabric Industry
1999 Misc. Textile Products Industries n.e.c.
2431 Men's and Boys' Coat Industry
2432 Men's and Boys' Suit and Jacket Industry
2433 Men's and Boys' Pants Industry
2434 Men's and Boys' Shirt and Underwear Industry
2435 Men's and Boys' Clothing Contractors
2441 Women's Coat and Jacket Industry
2442 Women's Sportswear Industry
2443 Women's Dress Industry
2444 Women's Blouse and Shirt Industry
2445 Women's Clothing Contractors
2451 Children's Clothing Industry
2491 Sweater Industry
2492 Occupational Clothing Industry
2493 Glove Industry
2494 Hosiery Industry

2495 Fur Goods Industry
2496 Foundation Garment Industry
2499 Misc. Clothing and Apparel Industries n.e.c.
2561 Wooden Box and Pallet Industry
2591 Wood Preservation Industry
2611 Wooden Household Furniture Industry
2612 Upholstered Household Furniture Industry
2619 Other Household Furniture Industry
2641 Metal Office Furniture Industry
2649 Other Office Furniture Industries
2691 Bed Spring and Mattress Industry
3011 Power Boiler and Heat Exchanger Industry
3021 Metal Tanks (Heavy Gauge) Industry
3022 Plate Work Industry
3023 Pre-engineered Metal Buildings (except Portable)
3029 Other Fabricated Structural Metal Products
3031 Metal Door and Window Industry
3032 Prefabricated Portable Metal Buildings Industry
3039 Other Ornamental and Architecture Metal Products
3041 Custom Coating of Metal Products Industry
3042 Metal Closure and Container Industry
3049 Other Stamped and Pressed Metal Products
3091 Metal Plumbing Fixtures and Fittings Industry
3092 Metal Valve Industry
3099 Other Metal Fabricating Industries n.e.c.
3257 Motor Vehicle Fabric Accessories Industry
3281 Boatbuilding and Repair Industry
3332 Electric Lamp and Shade Industry
3333 Electric Lamp (Bulb and Tube) Industry
3921 Jewellery and Silverware Industry
3922 Precious Metal Secondary Refining Industry
3991 Broom, Brush and Mop Industry
3992 Button, Buckle and Clothes Fastener Industry
3993 Floor Tile, Linoleum and Coated Fabrics
3994 Musical Instruments and Sound Recording
3999 Other Manufactured Products Industries, n.e.c.

Scale-based Sector

1511 Tire and Tube Industry
1521 Rubber Hose and Belting Industry
1599 Other Rubber Products Industries
2512 Sawmill and Planing Mill Products Industry
2711 Pulp Industry
2712 Newsprint Industry
2713 Paperboard Industry
2714 Building Board Industry
2719 Other Paper Industries
2721 Asphalt Roofing Industry
2731 Folding Carton and Set-up Box Industry
2732 Corrugated Box Industry
2733 Paper Bag Industry
2811 Business Forms Printing Industry
2819 Other Commercial Printing Industries
2821 Platemaking, Typesetting and Bindery Industry
2841 Newspapers, Magazines and Periodicals

2849 Other Combined Publishing and Printing
2911 Ferro-alloys Industry
2912 Steel Foundries
2919 Other Primary Steel Industries
2921 Steel Pipe and Tube Industry
2941 Iron Foundries
2999 Other Metal Rolling, Casting and Extruding
3051 Upholstery and Coil Spring Industry
3052 Wire and Wire Rope Industry
3053 Industrial Fastener Industry
3059 Other Wire Products Industries
3231 Motor Vehicle Industry
3241 Truck and Bus Body Industry
3242 Commercial Trailer Industry
3251 Motor Vehicle Engine and Engine Parts Industry
3252 Motor Vehicle Wiring Assemblies Industry
3253 Motor Vehicle Stampings Industry
3254 Motor Vehicle Steering and Suspension Industry
3255 Motor Vehicle Wheel and Brake Industry
3256 Motor Vehicle Plastic Parts Industry
3259 Other Motor Vehicle Accessories and Parts
3261 Railroad Rolling Stock Industry
3271 Shipbuilding and Repair Industry
3299 Other Transportation Equipment Industries
3512 Imported Clay Products Industry
3561 Primary Glass and Containers Industry
3562 Glass Products (except Containers) Industry
3571 Abrasives Industry
3711 Industrial Inorganic Chemicals n.e.c.
3712 Industrial Organic Chemicals n.e.c.
3721 Chemical Fertilizer Industry
3722 Mixed Fertilizer Industry
3729 Other Agricultural Chemical Industries
3731 Plastic and Synthetic Resin Industry
3791 Printing Ink Industry

Product differentiated Sector

3061 Basic Hardware Industry
3062 Metal Dies, Moulds and Patterns Industry
3063 Hand Tool and Implement Industry
3069 Other Hardware and Cutlery Industries
3071 Heating Equipment Industry
3081 Machine Shop Industry
3111 Agricultural Implement Industry
3121 Commercial Refrigeration Equipment Industry
3191 Compressor, Pump and Industrial Fan Industry
3192 Construction Mining and Handling Machinery
3193 Sawmill and Woodworking Machinery
3194 Turbine and Power Transmission Equipment
3199 Other Machinery and Equipment Industries, n.e.c.
3243 Non-commercial Trailer Industry
3244 Mobile Home Industry
3311 Small Electrical Appliance Industry
3321 Major Appliances (Electric and non-electric)
3331 Lighting Fixture Industry

3361 Electronic Computers and Peripheral Equipment
3362 Electronic Office, Store and Business Machine Industry
3369 Other Office, Store and Business Machine Industries
3381 Communications and Energy Wire and Cable Industry
3391 Battery Industry
3392 Non-current Carrying Wiring Devices Industry
3399 Other Electrical Products Industries, n.e.c.
3771 Toilet Preparations Industry
3931 Sporting Goods Industry
3932 Toys and Games Industry

Science-based Sector

3211 Aircraft and Aircraft Parts Industry
3341 Record Players, Radio and TV Receivers Industry
3351 Telecommunication Equipment Industry
3352 Electronic Parts and Components Industry
3359 Other Electronic Equipment Industries
3371 Electrical Transformer Industry
3372 Electrical Switchgear and Protective Equipment
3379 Other Electrical Industrial Equipment
3741 Pharmaceutical and Medicine Industry
3751 Paint and Varnish Industry
3761 Soap and Cleaning Compounds Industry
3792 Adhesives Industry
3799 Other Chemical Products Industries n.e.c.
3911 Indicating and Recording Instruments Industry
3912 Other Instruments and Related Products
3913 Clock and Watch Industry
3914 Ophthalmic Goods Industry

Appendix 3: Annual Growth Rates for Employment by Sector, 1976-1997

	Natural Resources			Labour Intensive			Scale-based			Product-differentiated			Science-based		
	Toronto	Montreal	Vancouver	Toronto	Montreal	Vancouver	Toronto	Montreal	Vancouver	Toronto	Montreal	Vancouver	Toronto	Montreal	Vancouver
1977	(1.7)	(5.6)	3.0	(5.6)	(9.0)	(3.4)	1.8	(7.4)	3.7	(9.4)	(3.1)	(2.0)	(6.0)	(4.0)	(17.6)
1978	5.8	2.8	7.7	5.4	(1.2)	3.7	7.7	7.7	12.4	7.8	7.5	15.5	10.0	15.7	8.7
1979	4.0	0.5	(0.5)	2.6	1.6	7.5	6.3	1.0	6.8	10.0	(3.7)	15.9	9.4	22.5	3.6
1980	(0.5)	(0.4)	(0.6)	(1.7)	(6.7)	10.7	(3.9)	1.8	(9.4)	(0.4)	(0.4)	(4.3)	8.7	13.8	22.5
1981	(1.2)	(2.9)	2.4	3.6	(3.7)	3.0	(3.3)	2.4	(2.1)	(1.0)	(0.5)	(8.1)	(0.5)	(1.9)	2.9
1982	(4.4)	(9.0)	(12.5)	(4.8)	(7.8)	(12.8)	(6.8)	(16.3)	(11.1)	(13.8)	(9.4)	(17.4)	(11.6)	(8.5)	(13.2)
1983	(0.5)	0.8	(0.2)	0.8	1.4	(6.9)	9.7	2.8	(8.9)	(4.0)	(1.0)	(7.4)	(0.5)	(9.6)	(6.4)
1984	2.0	2.2	(2.1)	3.3	2.3	(6.5)	13.1	4.5	0.8	7.3	4.3	(2.8)	5.0	(7.4)	4.3
1985	9.4	4.6	8.8	7.7	1.3	12.0	9.8	4.9	5.9	13.8	0.1	16.1	6.7	9.7	11.2
1986	8.1	3.0	1.9	7.1	3.9	(2.9)	3.8	0.0	(3.8)	6.7	8.7	6.4	4.7	(2.2)	4.4
1987	4.7	5.7	1.1	4.7	2.2	9.3	0.9	5.2	6.2	10.2	5.7	20.2	5.1	2.2	2.1
1988	5.8	3.9	6.0	(0.1)	0.7	21.4	3.3	3.8	8.4	9.2	3.7	15.8	9.4	14.6	42.4
1989	6.9	(5.7)	8.7	5.4	(8.6)	18.1	3.9	(1.7)	(2.0)	2.4	(0.6)	8.2	(3.0)	(1.9)	9.4
1990	(6.2)	(0.2)	(1.4)	(11.4)	(3.3)	(10.1)	(4.2)	(8.0)	(5.3)	(12.1)	(6.8)	(5.4)	(2.8)	1.4	(12.6)
1991	(6.7)	(11.0)	(7.1)	(5.1)	(17.7)	(8.3)	(5.3)	(19.8)	(5.8)	(3.4)	(20.7)	(15.1)	(6.0)	(9.1)	(13.8)
1992	(6.8)	(5.3)	8.3	(20.6)	(8.2)	(2.1)	(1.1)	(1.1)	12.2	(12.1)	(3.9)	2.9	4.7	0.5	24.1
1993	1.2	(1.8)	(0.9)	(1.2)	(4.1)	(9.0)	(2.8)	4.7	(1.5)	(3.1)	(1.1)	(2.6)	(14.9)	(1.7)	2.0
1994	1.8	2.9	(5.0)	(1.4)	2.3	(1.7)	(0.6)	4.4	(2.2)	(1.7)	12.2	3.4	(4.2)	1.3	0.2
1995	1.5	0.9	6.7	1.6	(2.9)	(1.3)	4.8	(0.9)	0.9	8.2	3.2	3.8	2.1	4.3	8.2
1996	8.1	3.5	2.3	10.4	2.5	15.3	1.4	(2.1)	5.2	13.1	2.3	7.6	7.2	2.8	14.2
1997	4.7	6.0	(1.0)	4.5	4.0	3.5	3.1	2.1	(1.0)	4.3	8.1	12.3	2.6	3.4	7.7
Average	**1.7**	**(0.2)**	**1.2**	**0.2**	**(2.4)**	**1.9**	**2.0**	**(0.6)**	**0.4**	**1.5**	**0.2**	**3.0**	**1.2**	**2.2**	**5.0**
Std. Dev.	**5.0**	**4.8**	**5.5**	**7.0**	**5.6**	**9.8**	**5.4**	**7.0**	**6.8**	**8.6**	**7.2**	**10.7**	**7.0**	**8.7**	**14.0**
Variance	**24.9**	**22.7**	**29.9**	**49.5**	**31.4**	**95.8**	**29.2**	**49.6**	**45.7**	**73.3**	**51.6**	**114.6**	**49.3**	**76.4**	**196.3**

Note: (1) Toronto, Montreal and Vancouver are defined using census divisions rather than by the standard CMA definitions.
(2) Production workers only.

Appendix 4: Employment Change by Sector, 1976-1997 (1986=100)

	Natural Resources			Labour Intensive			Scale-based			Product-differentiated			Science-based		
	Toronto	Montreal	Vancouver	Toronto	Montreal	Vancouver	Toronto	Montreal	Vancouver	Toronto	Montreal	Vancouver	Toronto	Montreal	Vancouver
1976	82	105	94	84	121	99	70	101	109	87	99	94	79	80	87
1977	81	99	97	79	110	95	71	93	113	79	96	92	75	77	72
1978	85	102	104	84	109	99	77	101	127	85	103	107	82	89	78
1979	89	102	104	86	110	106	82	102	136	94	99	124	90	109	81
1980	88	102	103	84	103	118	79	104	123	94	99	118	98	124	99
1981	87	99	105	87	99	121	76	106	120	93	98	109	97	122	102
1982	83	90	92	83	91	106	71	89	107	80	89	90	86	111	88
1983	83	91	92	84	93	98	78	91	97	77	88	83	85	101	83
1984	85	93	90	87	95	92	88	95	98	82	92	81	90	93	86
1985	92	97	98	93	96	103	96	100	104	94	92	94	96	102	96
1986	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
1987	105	106	101	105	102	109	101	105	106	110	106	120	105	102	102
1988	111	110	107	105	103	133	104	109	115	120	110	139	115	117	145
1989	118	104	116	110	94	157	108	107	113	123	109	151	112	115	159
1990	111	103	115	98	91	141	104	99	107	108	102	143	108	116	139
1991	104	92	107	93	75	129	98	79	101	105	81	121	102	106	120
1992	97	87	116	74	69	126	97	78	113	92	77	124	107	106	149
1993	98	86	115	73	66	115	95	82	111	89	77	121	91	105	152
1994	100	88	109	72	67	113	94	86	109	88	86	125	87	106	152
1995	101	89	116	73	65	112	98	85	110	95	89	130	89	110	164
1996	109	92	119	80	67	129	100	83	115	107	91	140	95	114	188
1997	114	97	118	84	70	133	103	85	114	112	98	157	98	117	202

Note: (1) Toronto, Montreal and Vancouver are defined using census divisions rather than by the standard CMA definitions.
(2) Production workers only.

Appendix 5: Correlation of Employment Growth Rates Between Sectors

	Toronto				
	Natural Resources	Labour Intensive	Scale-based	Product-differentiated	Science-based
Natural Resources	1.00				
Labour Intensive	0.86	1.00			
Scale-based	0.60	0.50	1.00		
Product-differentiated	0.86	0.82	0.62	1.00	
Science-based	0.50	0.34	0.53	0.68	1.00

	Montreal				
	Natural Resources	Labour Intensive	Scale-based	Product-differentiated	Science-based
Natural Resources	1.00				
Labour Intensive	0.92	1.00			
Scale-based	0.78	0.72	1.00		
Product-differentiated	0.82	0.80	0.81	1.00	
Science-based	0.48	0.33	0.47	0.30	1.00

	Vancouver				
	Natural Resources	Labour Intensive	Scale-based	Product-differentiated	Science-based
Natural Resources	1.00				
Labour Intensive	0.59	1.00			
Scale-based	0.67	0.46	1.00		
Product-differentiated	0.63	0.71	0.74	1.00	
Science-based	0.57	0.72	0.49	0.54	1.00

Note: (1) Cities are defined using census divisions rather than by the standard CMA definitions.
(2) Production workers only.

Appendix 6: Relative Wage Rates for Production Workers by Sector (unadjusted), 1976-1997

	Natural Resources			Labour Intensive			Scale-based			Product-differentiated			Science-based		
	Toronto	Montreal	Vancouver	Toronto	Montreal	Vancouver	Toronto	Montreal	Vancouver	Toronto	Montreal	Vancouver	Toronto	Montreal	Vancouver
1976	1.02	1.02	1.23	1.06	0.91	0.91	0.97	0.90	1.12	1.02	0.92	1.19	1.01	1.02	1.02
1977	0.99	1.01	1.24	1.04	0.92	0.92	0.97	0.90	1.14	0.99	0.93	1.20	0.99	1.05	1.04
1978	0.98	1.01	1.22	1.03	0.93	0.93	0.96	0.92	1.12	0.98	0.95	1.20	1.00	1.06	1.01
1979	0.98	1.00	1.23	1.01	0.94	0.94	0.95	0.93	1.12	0.98	0.91	1.19	1.01	1.04	1.00
1980	0.97	1.00	1.23	1.02	0.94	0.94	0.92	0.94	1.16	0.99	0.89	1.22	1.01	1.04	0.96
1981	0.97	1.01	1.20	1.01	0.94	0.94	0.94	0.93	1.15	0.98	0.90	1.23	0.98	1.09	1.00
1982	0.96	1.02	1.19	1.01	0.93	0.93	0.92	0.91	1.18	0.98	0.93	1.21	1.00	1.05	1.08
1983	0.96	1.02	1.21	1.01	0.91	0.91	0.93	0.92	1.15	0.98	0.92	1.20	1.00	1.08	1.01
1984	0.97	1.03	1.19	1.03	0.91	0.91	0.93	0.90	1.09	1.00	0.93	1.22	0.99	1.09	1.00
1985	0.99	1.03	1.16	1.05	0.92	0.92	0.94	0.89	1.07	0.99	0.92	1.23	1.00	1.06	1.01
1986	0.99	1.02	1.13	1.06	0.92	0.92	0.95	0.90	1.09	1.00	0.91	1.20	1.05	1.03	0.93
1987	0.99	1.03	1.13	1.05	0.93	0.93	0.95	0.90	1.06	0.99	0.95	1.14	1.03	1.06	0.90
1988	0.98	1.02	1.12	1.06	0.91	0.91	0.97	0.89	1.05	0.97	0.94	1.15	1.04	1.06	0.85
1989	0.97	1.03	1.10	1.04	0.91	0.91	0.98	0.89	1.07	0.98	0.96	1.14	1.04	1.08	0.88
1990	0.97	0.99	1.10	1.05	0.90	0.90	0.95	0.89	1.06	0.99	0.95	1.13	1.01	1.07	0.90
1991	0.96	1.01	1.08	1.01	0.91	0.91	0.96	0.88	1.05	0.98	0.98	1.09	1.00	1.09	0.91
1992	0.98	0.99	1.05	1.05	0.88	0.88	0.97	0.88	1.00	0.98	0.97	1.07	0.99	1.11	0.95
1993	0.99	1.00	1.03	1.04	0.87	0.87	0.99	0.90	1.00	0.99	0.94	1.11	0.98	1.10	0.90
1994	0.99	1.00	1.07	1.04	0.87	0.87	1.00	0.88	0.98	1.04	0.88	1.08	1.02	1.09	0.87
1995	0.99	1.00	1.05	1.05	0.89	0.89	0.98	0.86	0.99	1.04	0.88	1.13	1.02	1.08	0.86
1996	0.98	1.02	1.01	1.05	0.88	0.88	0.98	0.86	1.02	1.05	0.89	1.08	0.99	1.09	0.92
1997	1.00	0.99	1.03	1.08	0.87	0.87	1.01	0.87	1.01	1.02	0.87	1.08	1.02	1.04	0.90

Note: (1) Toronto, Montreal and Vancouver are defined using census divisions rather than by the standard CMA definitions.

Appendix 7: Relative Real Wages for Production Workers by Sector, 1976-1997 (1992 dollars)

	Natural Resources			Labour Intensive			Scale-based			Product-differentiated			Science-based		
	Toronto	Montreal	Vancouver	Toronto	Montreal	Vancouver	Toronto	Montreal	Vancouver	Toronto	Montreal	Vancouver	Toronto	Montreal	Vancouver
1976	1.05	1.04	1.17	1.09	0.94	1.13	0.99	0.92	1.07	1.04	0.94	1.13	1.03	1.04	0.97
1977	1.02	1.03	1.19	1.07	0.94	1.16	0.99	0.92	1.09	1.02	0.95	1.15	1.02	1.07	0.99
1978	1.01	1.04	1.18	1.06	0.95	1.16	0.99	0.94	1.08	1.01	0.97	1.16	1.03	1.09	0.98
1979	1.01	1.02	1.21	1.04	0.96	1.17	0.98	0.96	1.10	1.01	0.93	1.16	1.04	1.07	0.98
1980	1.00	1.02	1.21	1.05	0.96	1.19	0.94	0.96	1.14	1.02	0.91	1.20	1.04	1.07	0.95
1981	0.99	1.03	1.16	1.04	0.96	1.20	0.97	0.95	1.12	1.01	0.92	1.19	1.01	1.11	0.97
1982	0.98	1.04	1.15	1.03	0.94	1.21	0.94	0.93	1.15	1.00	0.95	1.17	1.03	1.07	1.05
1983	0.98	1.04	1.18	1.03	0.93	1.23	0.95	0.94	1.12	1.01	0.94	1.17	1.02	1.10	0.98
1984	0.99	1.05	1.17	1.05	0.93	1.21	0.95	0.91	1.07	1.02	0.95	1.19	1.01	1.11	0.98
1985	1.01	1.05	1.15	1.07	0.93	1.13	0.95	0.91	1.06	1.00	0.94	1.21	1.02	1.08	0.99
1986	1.00	1.03	1.13	1.07	0.93	1.10	0.96	0.91	1.09	1.01	0.92	1.20	1.06	1.04	0.93
1987	0.99	1.03	1.14	1.06	0.94	1.08	0.96	0.90	1.07	0.99	0.96	1.15	1.03	1.07	0.91
1988	0.97	1.03	1.13	1.05	0.92	1.02	0.96	0.89	1.06	0.97	0.95	1.16	1.03	1.07	0.86
1989	0.95	1.04	1.12	1.01	0.92	1.04	0.96	0.91	1.09	0.96	0.98	1.15	1.01	1.10	0.89
1990	0.96	1.02	1.11	1.03	0.92	1.06	0.93	0.90	1.07	0.97	0.97	1.14	0.99	1.10	0.91
1991	0.95	1.01	1.09	1.00	0.92	1.08	0.95	0.88	1.07	0.97	0.98	1.10	0.99	1.10	0.92
1992	0.98	0.99	1.05	1.05	0.88	1.05	0.97	0.88	1.00	0.98	0.97	1.07	0.99	1.11	0.95
1993	0.99	1.00	1.01	1.04	0.88	1.05	0.99	0.91	0.98	1.00	0.95	1.09	0.98	1.10	0.89
1994	1.00	1.02	1.03	1.04	0.89	1.03	1.00	0.89	0.94	1.04	0.90	1.04	1.02	1.11	0.84
1995	0.99	1.02	1.01	1.05	0.91	1.02	0.98	0.88	0.95	1.04	0.90	1.08	1.02	1.11	0.82
1996	0.98	1.04	0.98	1.05	0.90	1.02	0.98	0.89	0.99	1.05	0.91	1.05	0.99	1.12	0.89
1997	0.99	1.02	1.01	1.07	0.89	1.05	1.01	0.90	0.99	1.02	0.89	1.06	1.02	1.07	0.88

Note: (1) Toronto, Montreal and Vancouver are defined using census divisions rather than by the standard CMA definitions.
(2) Real wages are adjusted using the city-specific Consumer Price Indices (CPI)

Appendix 8: Concentration, Diversity and Industry Change Measures, 1976-1997

	Number of Industries (Max=236)			Top Four Industry Concentration Index			Herfindahl Index			Industry Share Change Index		
	Toronto	Montreal	Vancouver	Toronto	Montreal	Vancouver	Toronto	Montreal	Vancouver	Toronto	Montreal	Vancouver
1976	225	225	202	0.15	0.10	0.21	0.013	0.010	0.022	0.044	0.050	0.043
1977	225	226	205	0.15	0.10	0.22	0.014	0.010	0.024	0.049	0.055	0.057
1978	224	229	207	0.14	0.11	0.22	0.013	0.011	0.024	0.042	0.057	0.060
1979	226	227	210	0.15	0.12	0.21	0.013	0.012	0.023	0.046	0.045	0.068
1980	227	227	210	0.15	0.13	0.20	0.013	0.012	0.021	0.041	0.056	0.065
1981	228	229	207	0.14	0.13	0.19	0.012	0.013	0.020	0.053	0.055	0.080
1982	226	227	210	0.14	0.14	0.20	0.013	0.013	0.021	0.050	0.052	0.065
1983	227	227	207	0.14	0.13	0.20	0.013	0.013	0.021	0.045	0.048	0.060
1984	225	226	211	0.16	0.13	0.19	0.014	0.012	0.021	0.042	0.050	0.052
1985	223	225	211	0.16	0.14	0.19	0.015	0.012	0.021	0.047	0.047	0.089
1986	224	227	213	0.16	0.14	0.19	0.014	0.012	0.020	0.039	0.044	0.060
1987	226	227	212	0.16	0.14	0.20	0.014	0.013	0.021	0.046	0.046	0.067
1988	228	229	217	0.16	0.14	0.19	0.014	0.013	0.019	0.041	0.041	0.063
1989	226	228	219	0.16	0.15	0.18	0.014	0.013	0.018	0.047	0.058	0.058
1990	226	228	216	0.17	0.16	0.17	0.015	0.014	0.017	0.043	0.051	0.063
1991	226	228	216	0.18	0.17	0.18	0.015	0.015	0.017	0.063	0.046	0.080
1992	225	224	213	0.18	0.18	0.18	0.017	0.016	0.018	0.051	0.043	0.071
1993	225	225	210	0.18	0.18	0.19	0.016	0.016	0.019	0.038	0.040	0.050
1994	225	225	208	0.17	0.17	0.19	0.016	0.015	0.019	0.043	0.043	0.059
1995	226	227	210	0.17	0.17	0.19	0.016	0.016	0.019	0.046	0.044	0.091
1996	227	225	210	0.17	0.18	0.19	0.015	0.017	0.018	0.043	0.041	0.060
1997	227	224	209	0.16	0.18	0.18	0.015	0.017	0.018			

Note: (1) Toronto, Montreal and Vancouver are defined using census divisions rather than by the standard CMA definitions.
(2) Concentration, Herfindahl, and Industrial Share Change indices calculated using production workers only.

Appendix 9: Decomposition of Volatility, 1976-1997

	Own Effect			Portfolio Effect			Total Effect		
	Toronto	Montreal	Vancouver	Toronto	Montreal	Vancouver	Toronto	Montreal	Vancouver
1976	8.5	9.5	13.1	20.3	18.8	26.9	28.8	28.3	40.0
1977	8.4	9.3	13.2	19.9	18.9	26.0	28.4	28.3	39.2
1978	8.4	9.1	13.2	19.9	19.2	26.1	28.3	28.3	39.3
1979	8.4	9.2	13.4	20.0	19.0	26.7	28.4	28.2	40.1
1980	8.3	9.0	13.2	20.1	19.2	27.6	28.4	28.2	40.9
1981	8.4	9.0	13.2	20.2	19.4	27.3	28.6	28.4	40.6
1982	8.4	9.1	13.3	19.9	19.2	27.0	28.3	28.2	40.3
1983	8.4	9.0	13.1	19.5	19.2	26.7	27.9	28.2	39.8
1984	8.4	9.0	13.0	19.4	19.3	26.7	27.8	28.3	39.7
1985	8.4	9.0	13.0	19.5	19.3	27.1	27.9	28.3	40.2
1986	8.4	8.9	12.9	19.6	19.4	27.4	28.0	28.3	40.3
1987	8.4	8.8	13.0	19.9	19.5	28.2	28.3	28.3	41.3
1988	8.3	8.8	13.2	20.0	19.5	29.7	28.4	28.3	42.9
1989	8.4	8.7	13.5	20.0	19.7	30.2	28.3	28.4	43.6
1990	8.2	8.7	13.3	19.7	19.5	29.5	27.9	28.3	42.8
1991	8.3	8.7	13.2	19.8	19.3	28.9	28.0	28.0	42.1
1992	8.1	8.7	13.0	19.2	19.5	28.8	27.3	28.2	41.8
1993	8.1	8.7	12.8	19.2	19.6	28.6	27.3	28.3	41.5
1994	8.1	8.6	12.9	19.2	19.8	29.2	27.2	28.4	42.1
1995	8.1	8.6	12.8	19.3	19.8	29.1	27.4	28.4	41.9
1996	8.1	8.6	13.0	19.7	19.8	29.9	27.8	28.3	42.8
1997	8.1	8.5	13.1	19.7	19.8	30.8	27.8	28.3	43.9
Average	**8.3**	**8.9**	**13.1**	**19.7**	**19.4**	**28.1**	**28.0**	**28.3**	**41.2**

Note: (1) Cities are defined using census divisions rather than the standard CMA definitions.

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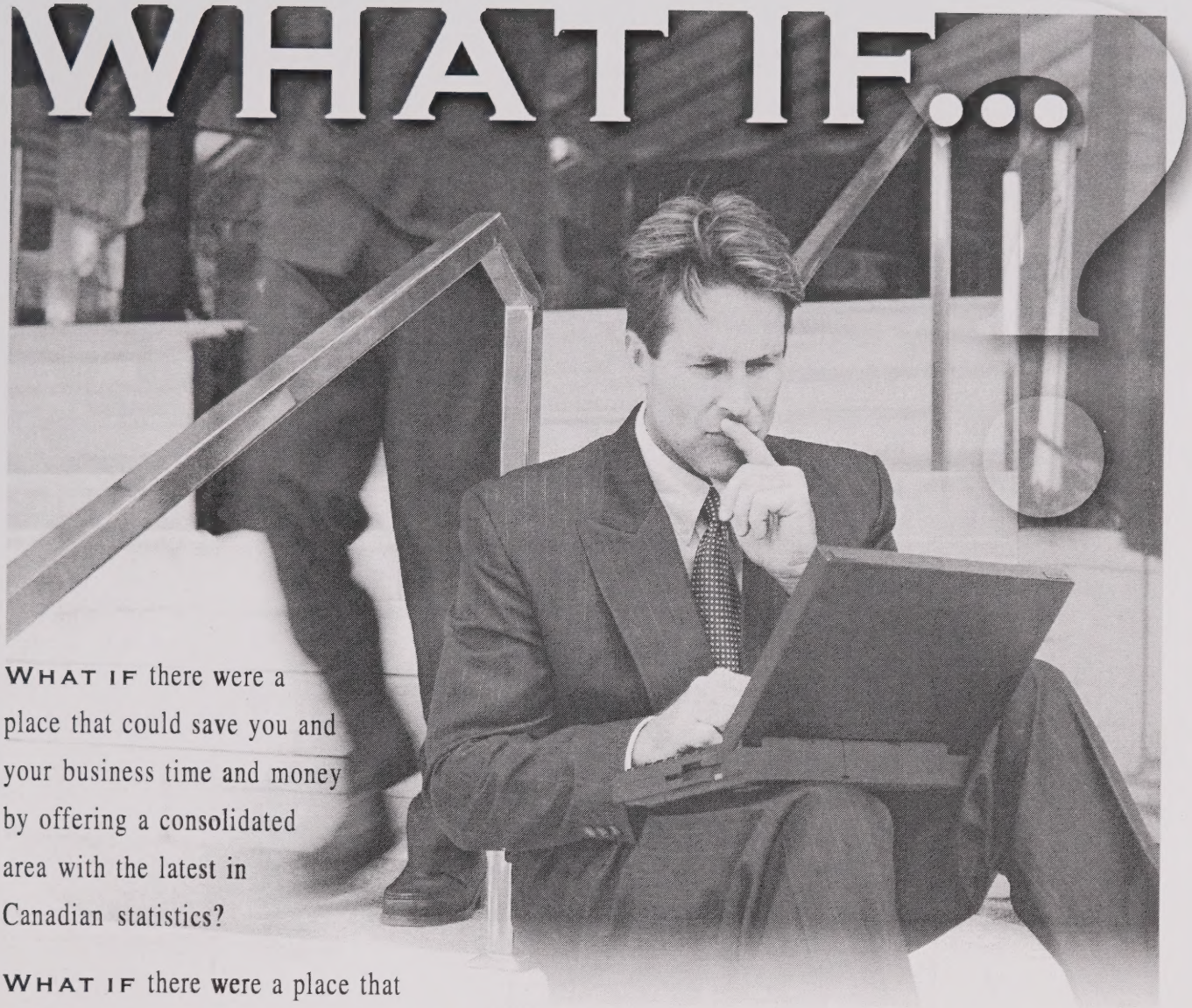

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